PC MAGAZINE

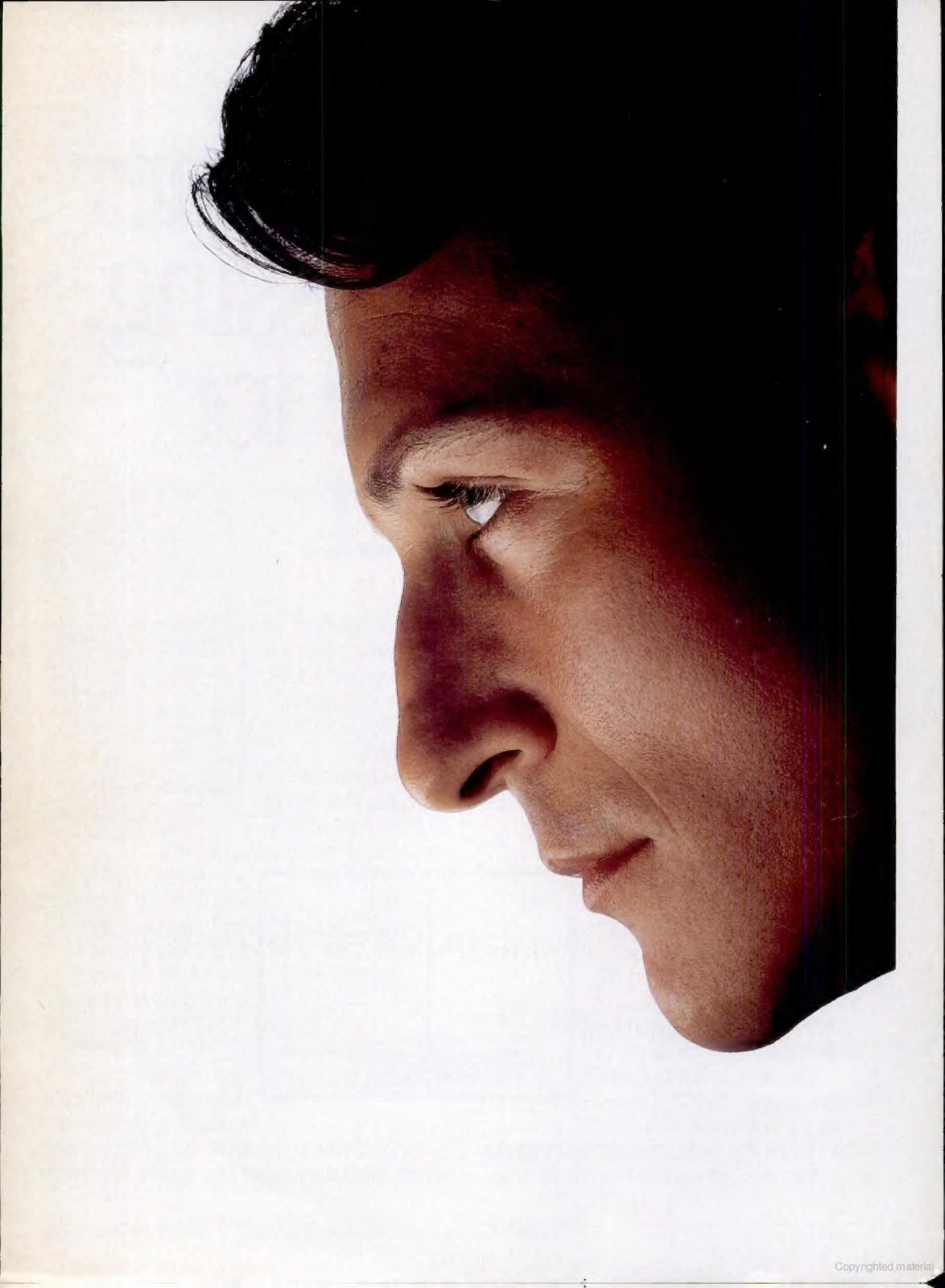
Windows 3.0 Is Here
Inside Windows 3.0
Windows 3.0 Tips & Tricks

Windows 3.0 Applications
Windows 3.0 Utilities
Windows 3.0 Programming

Presentation Graphics

How the PC-Based Graphics Packages Stack Up

We want you to
always view our monitors
in a certain way.



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If you want better word processing, don't settle for Perfect.

The trouble with WordPerfect® is, sometimes it isn't. Not when you compare it to our new Microsoft® Word version 5.0. Not when you consider that with Word 5.0, you'll pump out your day-to-day jobs quicker, easier, even smarter than you ever thought possible. On your IBM® PC or 100% compatible. It doesn't get much simpler than this.

Introducing new Microsoft Word 5.0. When Perfect just isn't good enough.

Example: With Word 5.0 you can choose commands by either using simple speed keys or just selecting from a menu.

You can tab, delete, italicize, move, change font and size, even cut and paste with about 50% fewer keystrokes than you-know-who.

Your workgroup can even make any annotations right on a document, then you can merge and collect all the comments. WordPerfect? No comment.

You can also sort, list, search and archive files across multiple directories, on your PC or across a network, thanks to the Word 5.0 document management and retrieval system.

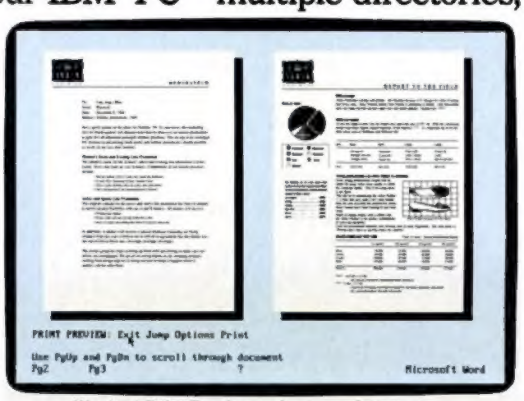
Or incorporate part, or all of a Lotus® 1-2-3,® Microsoft Excel or Microsoft Works spreadsheet into a Word document. And then update it. In seconds.

All of which is reason enough to try new Word 5.0. But for those who need a little more

COMMON WORDPROCESSING TASKS

Which requires fewer keystrokes?	Microsoft Word 5.0	WordPerfect 5.0
Copy Block	4	7
Delete Line	2	4
Italicize Word	2	5
Change Font and Size	6	9
Add Footer	1	7
Box Paragraph	5	12
Total	20	44

With new Word 5.0 you'll do about 50% less hunting and pecking than with WordPerfect.



Word 5.0 Print Preview makes sure what you see is what you want. Before you print it.

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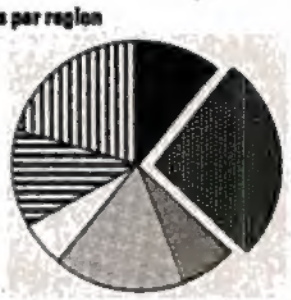
ARBOR
FOOTWEAR

REPORT TO THE FIELD

Sales per region



- Northwest
- Southwest
- Northeast
- Southeast
- East
- West
- Midwest

The following are the most recent Telex numbers for the Arbor regional sales offices. All client and distributor inquiries should be directed to these numbers.

Los Angeles	08785
Atlanta	05788
Chicago	07858
New York	08857
Miami	05876
Detroit	06875

Shoe enough

Arbor Footwear comings and goings: Jim Dearing becomes V.P. Design for Arbor Evening and Dress wear. Greg Vroonas moves from Peoria to marketing in Miami. Joan MacArthur and Lisa Doan become account supervisor and media planner, respectively. *1 Midge C.*

Sales per region

Across the board it looks like the South once again led sales in FY '88. With the continuing pump craze those figures should maintain, if not improve. *2 Jim W.* It's important not to let the other areas such as Northeast and Midwest fall.

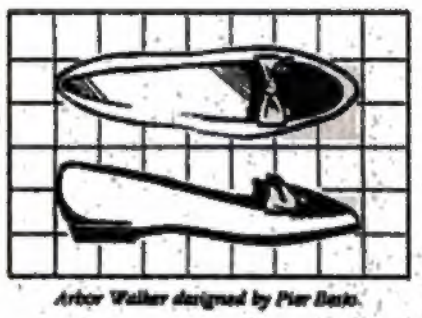
Style:	Dress	Sport	Career	Casual
	Evening oxi	Weekender	Tailor made	Trouser tip
	Midnight moccasin	Kickaround	Ladies wingtip	Loafer
	Twilight todess	Runner up	M.B.A.-bound	Special spectator
Price:	$150-$350	$85-$125	$120-$250	$90-$150

Young professionals use Arbor Walker to commute.

Soon, young professional women will no longer be using Arbor shoes simply to climb the corporate ladder. They'll be using them to get there.

This fall we're introducing the Arbor Walker — a shoe that goes quite a few steps further than the now-accepted but unattractive tennis shoes women have been wearing to and from work.

Made of Italian leather with a rubber sole, the Arbor Walker is the perfect combination of style and durability.



Arbor Walker designed by Pier Basto.

Look for promotional materials and carrying cases in early September. Our sales point is: "Women don't have to sacrifice looks for comfort."

SALES FORECAST FOR 1989

Types of shoes: Summer/Fall/Holiday/Spring

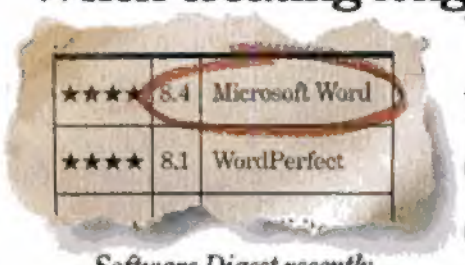
	1st quarter	*2nd quarter*	*3rd quarter*	*4th quarter*
Dress	95,000	87,000	120,000	60,000
Career	40,000	82,000	60,000	90,000
Casual	120,000	85,000	75,000	80,000
Sport	135,000	60,000	90,000	87,000
TOTAL:	390,000	314,000	345,000	317,000

Midge C. 9/27/88, 4:32 PM
let's discuss forecast for media department expansion.

Jim W. 7/1/88, 1:15 PM
Figures for Northeast and Midwest should be calculated separately mid-month let's catch them before they fall with promo.

Text, graphics, fonts, annotations. Faster, simpler, cleaner. Compliments of new Microsoft Word 5.0.

convincing, picture this: Outline View. When creating longer documents, Outline View lets you switch to a view of headings only. Which means you can see the structure of your entire document, and rearrange it just by rearranging your headings.



Software Digest recently chose the best overall advanced word processor on the market. Who won? In a word, Word.

We could go on and on with more advantages. But your best bet is to call for a convincing demo at: (800) 541-1261, Dept. J62. After you call us, try calling WordPerfect for a demo. Run both, our Word against theirs, head to head, and then ask yourself:

Which one brings your word processing closer to perfection?

Microsoft®

Making it all make sense.

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CIRCLE 280 ON READER SERVICE CARD

Inside

You may not notice a difference, but you are holding the firstfruits of a new harvest season for PC Labs. This is the first issue of *PC Magazine* that's been nurtured from a seedling to maturity by one of the world's foremost experts on orchids, Frederic E. Davis. Or was that Frederic E. Davis, the new Director of PC Labs? Either way, we're proud to have him as part of our team.

The son of an IBM Fellow, Davis literally grew up on computers. He participated in a beta test of the BASIC language at age 11 and has been on the ground floor of programming for 23 years. He has witnessed the development of the personal computer from the inside as have few others. He used mainframe computing in his botanical research laboratory in Maine in the mid-1970s. When he decided to move his lab to California, mutual friends from MIT introduced him to "two guys named Steve who'd just sold their Volkswagen to start a computer company named after a fruit." Typically, he quickly embraced and mastered the new Apple standard, while keeping on top of the other simultaneous developments in the nascent microcomputer industry.

In fact, he's been around long enough to call himself a "platform agnostic." He's seen them come and go, he's familiar with them all, and he doesn't pull any punches when stating what he likes and dislikes about any particular operating environment or hardware standard.

Former *MacUser* editor-in-chief Fred Davis says the latest generation of PCs look and feel pretty good.

PHOTOGRAPH: THOM O'CONNOR

All of which makes him uniquely qualified for the task at hand: retooling the PC Labs to weather the coming standards storm. In order to remain the number-one independent testing center in the industry, PC Labs will need a leader with great experience and constant awareness of the bigger picture. Fred Davis is one of only a handful of people who could fill that bill.

Davis, a 6-year veteran of Ziff-Davis Publishing, comes to *PC Magazine* from *MacUser*, where he was Editor-in-Chief. Prior to that engagement, he served in the same capacity at *A+*. Of the ten books he has authored, four relate to the IBM-standard world, and one helped popularize the term *desktop publishing*. He has received awards from the computer press association; last year he was named "one of the 100 most influential leaders in the computer industry."

Inside this issue you'll find our annual look at the ever-expanding presentation graphics market—the keys to more-effective presentations. This year's crop is more capable than ever, giving you increased control from the planning stages to the applause. These presentation graphics programs support more forms of input, more output devices, and more fonts and graphics. They are designed to give Macintosh-based presentation graphics programs a run for their money.

—**Joseph J. Antinori** ■

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Everything it takes to add PostScript to your LaserJet II, including HP's blessing.

"The QMS JetScript controller is the best way available to add PostScript capabilities to a Hewlett-Packard LaserJet Series II printer."

–PC Week
Sept. 19, 1988

Hewlett-Packard* and QMS* have made it easy to give your LaserJet Series II* the desktop publishing power of the PostScript* page description language.

The new QMS JetScript™.

JetScript is the only Adobe PostScript controller upgrade authorized by HP and designed specifically for the LaserJet Series II. JetScript gives your printer the industry-standard page description language to accompany HP's PCL printer language. This expands your laser printing capabilities. Increases overall printer performance. Yet preserves HP functionality and warranties.

Do it yourself JetScript is easy to install. Just plug in two cards (one in your personal computer*, the other in your printer), connect a cable and install the software.

The result is a PostScript system with 35 resident Adobe typefaces, three megabytes of RAM, and QMS ASAP™ (Advanced System Architecture for PostScript) proprietary technology for superior performance. All for less than half the cost of a new PostScript laser printer.

New forms of expression The speed and power of JetScript combine to give your LaserJet Series II a form of expression that's found only with PostScript.

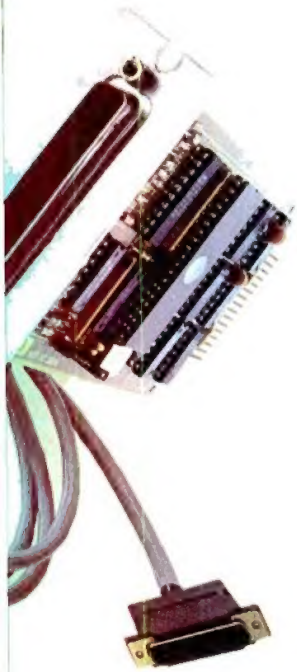
Simply, PostScript opens up the full range of possibilities for desktop publishing. You have complete control over the final look of the page, down to the last exacting detail. PostScript allows for an infinite number of font variations and sizes. That makes PostScript's limitless flexibility and power the perfect complement to your LaserJet Series II, giving you the high-quality output you require.

Impressive results People have come to expect impressive results from QMS—one of the first companies to bring the power of PostScript to laser printing, and now with more PostScript-based products than any other company.

You'll get the same results from the new JetScript. After all, it has HP's blessing.

Laser Connection is a sales and marketing subsidiary of QMS. Call **1-800-523-2696** for the location of your nearest Laser Connection dealer.

**JetScript available for IBM PC-XT™, IBM PC-AT™, HP Vectra™ and compatible personal computers, or the IBM PS/2™ Model 30.*



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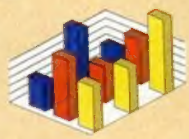

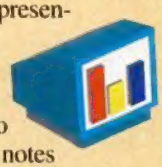

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To join, set your communications protocol at 7E1 (7 data bits, even parity, one stop bit), and set your modem at either 300 or 1,200 bits per second.

There are more than 500 phone numbers (at least one in every area code), but choose one of these for now: New York, (212) 422-8820; or San Francisco, (415) 296-0375. When the modem connects, press Ctrl-C. At the USER ID prompt, enter 177000,5000. At the PASSWORD prompt, enter PC*MAGNET. At the ENTER USER AGREEMENT NUMBER prompt, enter Z10D8900. CompuServe members can log on by entering GO PCMAGNET at any CompuServe prompt. Once you've joined, you can find a local access number by entering GO PHONES from any prompt. For more information, call (212) 503-5108.

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PC MAGAZINE EDITOR'S CHOICE Austin 286 12.5 January 31, 1989

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Austin 386/SX Price Matrix

Choose Hard Drive	Monitor & Video Adapter Card		
	Monochrome	VGA Color (640 × 480)	VGA Color (800 × 600)
40 MB HD (28 ms 1:1)	$1995	$2495	$2695
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Austin 286/12.5 Price Matrix

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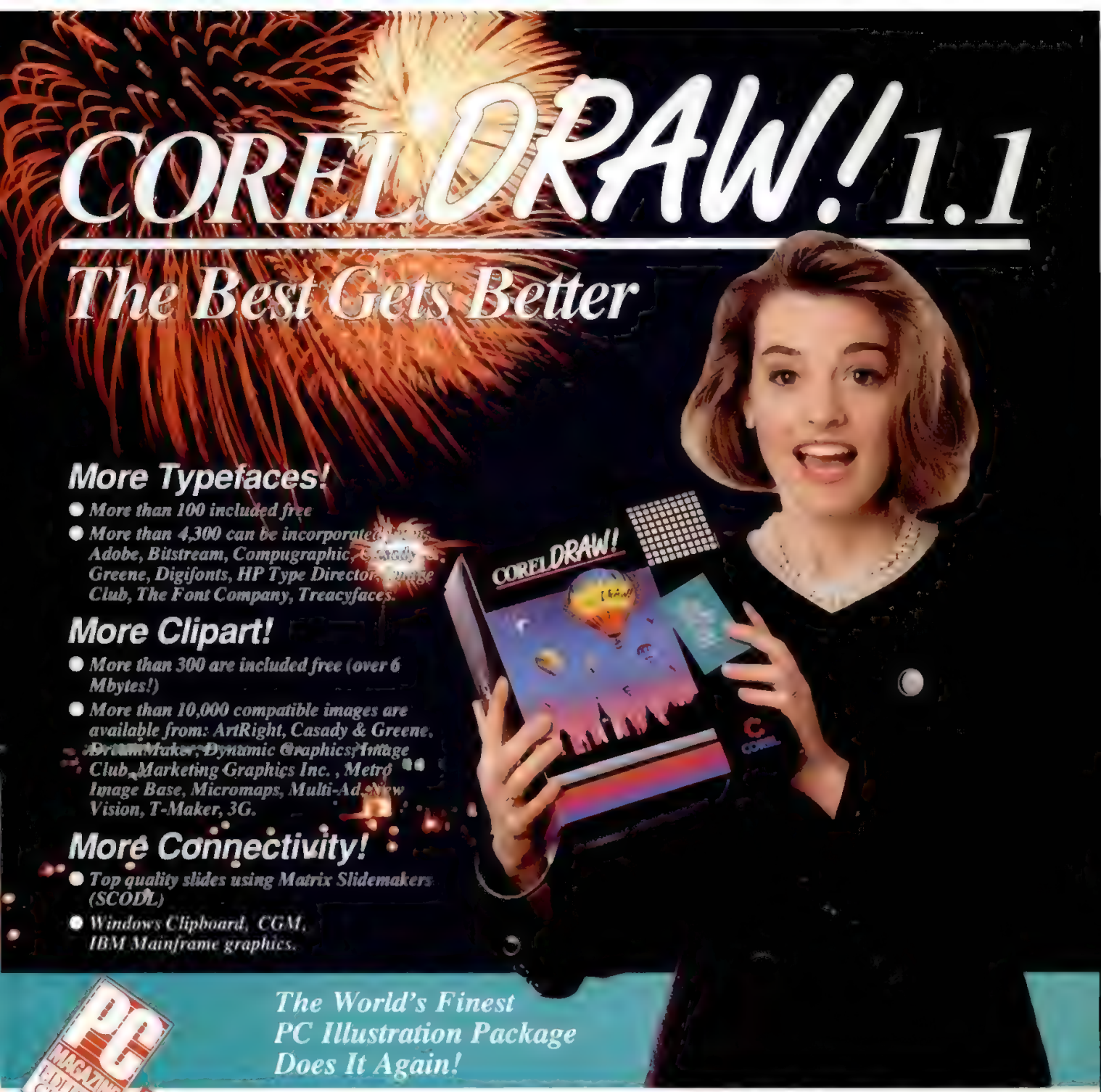

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Letters

NOT QUITE OUR TYPE

Having read the review of *Type Director* in your March 28, 1989, issue LaserJet (First Looks, p. 46), we anticipated a similarly positive assessment of the package in your June 13 feature on fonts ("Font Generators: Starting from Scratch"). Instead, we were confused and dismayed by a review that is inconsistent and contradictory to the earlier article.

In March, Edward Mendelson noted that the "Compugraphic fonts aren't better or worse than Bitstream's—but they're significantly different," the difference being a function of "personal taste" as much as suitability to page layout.

In the June review, however, Mr. Mendelson came to a different conclusion on the issue of typeface quality regarding the two packages. Once again comparing Bitstream's Dutch and Agfa Compugraphic's CG Times, he claimed that the typefaces produced by *Fontware* are "almost invariably the better designed."

Furthermore, in a move that is clearly not representative of *PC Magazine*'s normal approach, *Type Director* was measured against an unreleased version of *Fontware.* When we called Bitstream to obtain Release 3.0, we were told that a *WordPerfect* version was not yet available—but would be shortly. Are we talking vaporware?

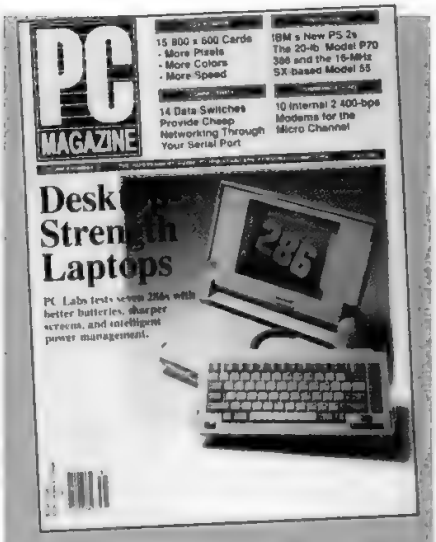
We recognize the impact of *PC Magazine* reviews on the marketplace and trust that you will rectify the situation.

Lonnie Christiansen
Manager
Marketing Programs
Font Technologies
Agfa Compugraphic
Wilmington, Massachusetts

The March 28 First Looks review was precisely that—a first look. Obviously, nothing happened to *Type Director* between March and June, but I had 3 more months of experience with the product. In that time, I realized one important point that was not obvious at first—that the Intellifont technology often offers better-looking curves and diagonals than the *Fontware* technology, and I made that point very clear in the later review.

However, I also realized that I should not have been so tentative in the First Looks review about criticizing the design of CG Times, as I now find that typeface even less easy to live with than I did then.

Bitstream did say that *Fontware* 3.0 would be shipping by the time the second review appeared, and 3.0 in fact did not ship at that time. But the product is hardly "vaporware." If it is not shipping at this moment, presumably that is because the documentation has not been printed, as you can download the complete, finished program from the *WordPerfect* BBS. —*Edward Mendelson*



A few small clarifications about a small computer.

RARING TO GO

As always, we enjoyed reading your recent review of laptops ("286 Laptops Compute en Route," *PC Magazine,* July 1989), in which your team did an excellent job of summing up the current offerings in this challenging category. We appreciated the sidebar treatment of the NEC ProSpeed 286, based upon the preproduction models that you evaluated.

As Bill Howard accurately predicted, we did begin shipping the ProSpeed 286 in May. We thought your readers would appreciate the following small clarifications of the information provided in the sidebar review.

The ProSpeed 286 keyboard *does* in fact have an embedded numeric keypad, so users do not need to add one externally unless they want to. Also, the ProSpeed does not accept the MultiSpeed modems. Instead, the ProSpeed family (286 and 386) supports a new, advanced, 2,400-bit-per-second modem design that allows its data access arrangement (DAA) to be shared with any communication-class expansion cards that are developed for the general purpose NEC LTX slot.

Thanks again for your continued excellent coverage of the fast-moving laptop market.

James D. Bartlett, Jr.
Manager
Strategic Marketing Group
NEC Home Electronics (USA) Inc.
Wood Dale, Illinois

SOME FRIES WITH THAT, MR. MANES?

Regarding Stephen Manes's statement in "Mr. Computer, Take a Letter—Please!" (*PC Magazine,* June 13, 1989) that form-letter software "eliminates the drudgery of having minimum-wage drones try to produce snappy, grammatically correct correspondence," I was under the impression that this class of software may also have been designed to increase efficiency and productivity. Manes clears up the misassumption when he later explains that the software has so far missed its mark because it has failed to include "missives on topics the clerical and temporary help simply can't be expected to understand."

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CIRCLE 316 ON READER SERVICE CARD

Letters

magazines, not to mention the more trivial expense of college tuition. Then, when we got old, we could all move to the People's Republic of Seattle, write snappy, grammatically correct articles, and become orgulous drones like Mr. Manes.

Brad DeMond
Kyoto-fu, Japan

THE FAX OF THE MATTER

In the Letters section of your June 27, 1989, issue, Curtis Hoke notes that fax machines could not have existed in the middle of the 19th century, as the telephone had not yet been invented. Although it is true that there was no telephone, there was a telegraph, and, indeed, a working fax. The inventor was a Catholic priest named Caselli, a physics teacher in Italy. In 1857 he moved to Paris to build his first prototype, which was in operation in 1863 (the first fax transmission took place over the telegraph line between Paris and Le Havre). Called the Pantélégraphe, the device was impressive in performance, boasting clear and detailed reception.

I think that this, Mr. Hoke, does get "the fax straight."

Jean-Marie Asselin
Mississauga, Ontario
Canada

PATENT ERROR?

I enjoy reading John Dvorak's comments, even on those occasions when he is wrong. A perfect example of this is his remarks on patent law (Inside Track, *PC Magazine*, July 1989). The content of his remarks is entertaining but inaccurate in at least one assertion. In the United States, patents cannot be obtained on inventions that have been in use for many years. Thus, the A:> prompt and the detachable keyboard are not patentable (they would also not be sufficiently inventive to meet the other tests of patentability).

It is also apparent that Mr. Dvorak is anti-patent, even though the patent law is not as he took it to be. This viewpoint is narrow and shortsighted. Mr. Dvorak sees patents as obstacles to free usage or to lower prices for consumers. Just the opposite is true.

Patents provide the economic incentive for inventions to be made public. They promote progress by allowing inventors to build on the inventions made public by others. This system of promoting progress by protecting those who publicly disclose their inventions in patents has worked well for over 200 years.

Chris H. Morgan
Shaker Heights, Ohio

The speculation of John C. Dvorak concerning the possibility of obtaining patents on well-known concepts such as the A:> prompt is quite entertaining but nevertheless based more on fiction than on fact (or law). Under the patent laws of the United States, a patent can only be obtained on an application filed less than 1 year after the public use or sale of the concept in this country or after the patenting or publication of the concept anywhere. Many foreign jurisdictions do not allow even this 1-year grace period.

It is apparent that John C. Dvorak is anti-patent, even though the patent law is not as he took it to be.

I read *PC Magazine* for the information on the computer world, both fact and opinion, that it provides. However, I find it a bit annoying that someone such as Mr. Dvorak should express opinions that extend into areas in which he obviously has little knowledge.

Kenton L. Freudenberg
Durango, Colorado

ROUNDUP REBUTTAL

In the May 30, 1989, issue of *PC Magazine*, the review of our Amax 386 computers includes a misstatement of fact ("80386: The Power and the Glory"). In his first paragraph, Bruce Brown writes that we are "taking the mail-order route." In fact, we do not sell through mail order, nor will we. Our customer base includes dealers, VARs, and OEM customers.

Jerry Shih
President
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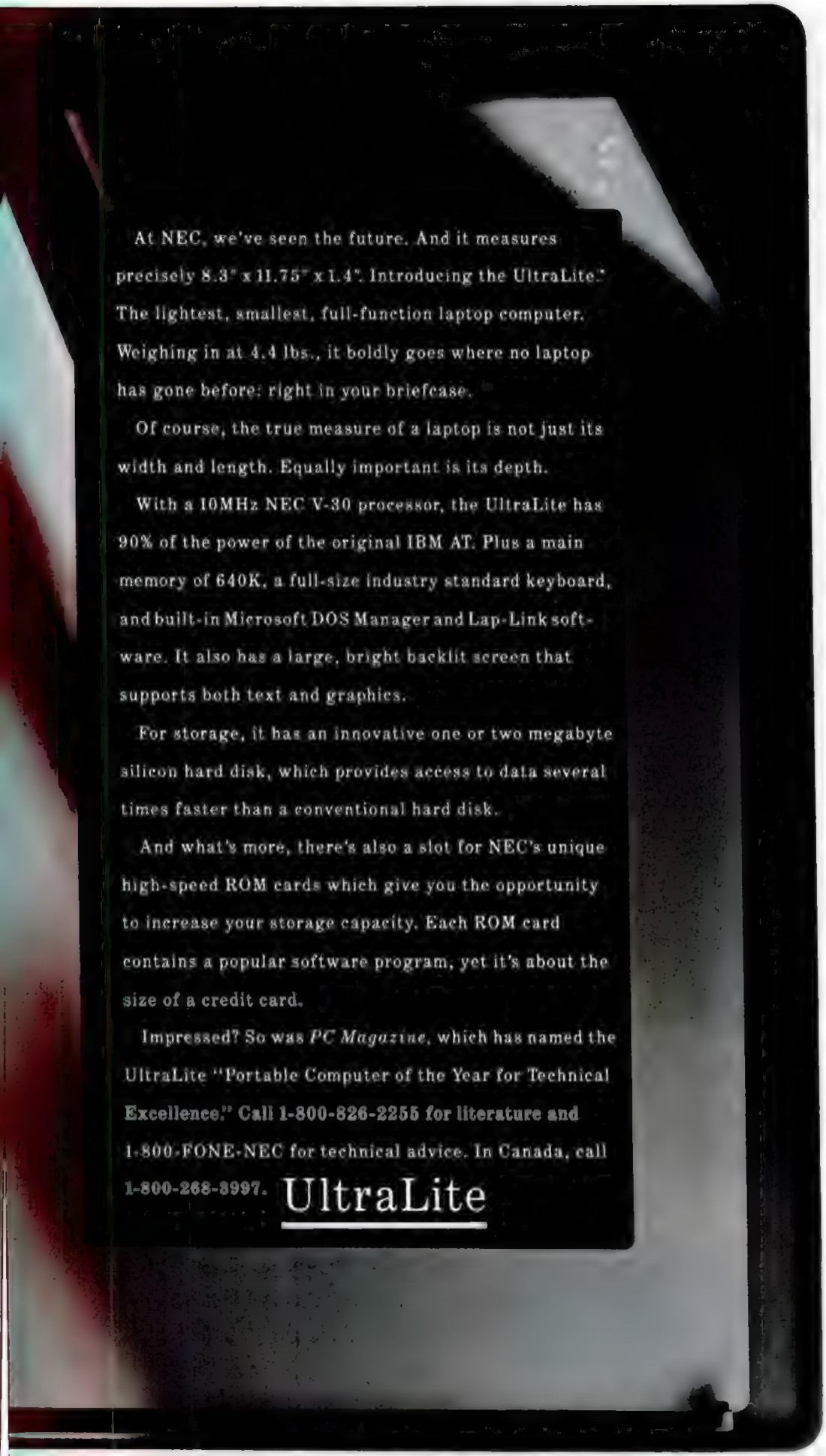

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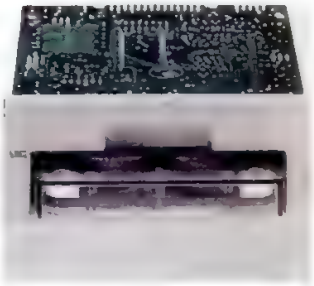

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Letters

In your May 30, 1989, roundup of 386 machines, the Swan 386 computers are blasted in four different paragraphs because of an 8MB memory limit. If this were an accurate criticism, I would have no problem with it. However, as you reported in your features table, our machines have a 16MB limit. Furthermore, the "8MB limit" inaccuracy was amplified to the point where it became the central theme of the review. Machines that actually had this limit were treated far more kindly by your staff for this shortcoming.

Peter Sattler
President
Tussey Computer Products Ltd.
State College, Pennsylvania

PC MAGAZINE Tussey's 386 computers have 16 SIMM sockets supporting up to 16MB of 32-bit RAM, rather than the 8MB reported in the May 30, 1989, review.

SURVIVAL OF THE FITTEST

In response to William F. Zachmann's article about MCA versus EISA (*PC Magazine*, June 27, 1989), it amazes me how similar this war is to the one that went on in the videocassette industry several years back.

Sony, you'll recall, wanted to charge a fee to other VCR manufacturers to use its Betamax format. The other manufacturers, in response, came up with their own format: VHS. As Beta's market share drastically dwindled, Sony eventually threw in the towel and turned to the VHS standard.

Looks to me like IBM is leading itself into the same trap Sony fell into. How many MCA machines will be sold or used 5 years from now? My guess is that most or all of IBM's PC line will be EISA machines.

Bob Kuzyk
Cockeysville, Maryland

PRIZE RIBBON

After reading W. F. Bolton's remarks about the print quality of the NEC Pinwriter 2200 (Letters, *PC Magazine*, January 31, 1989), I wrote to NEC Information Systems. Shortly thereafter, I received a call from a peripheral support representative who wanted to know what he could do to satisfy my complaint. I said that I believed the problem lay in the inking of the ribbon, and he promised to ask the engineering staff to look into it.

Subsequently, I received a sample of the redesigned ribbon, which does indeed work far better than what I'd been using. According to NEC, the part number hasn't changed, but, unlike the old ribbons, the new ones come in a black, red, and white cardboard box. Bolton and other Pinwriter 2200 owners should get improved results, provided that they purchase replacements from new stock.

Richard Wexler
Hyattsville, Maryland ■

How many Micro Channel architecture machines will be sold or used 5 years from now? My guess is that most or all of IBM's PC line will be EISA machines.

CORRECTIONS & AMPLIFICATIONS

In the July 1989 Advisor column, the wrong company, address, and phone number were listed for the Diconix 150 Plus. The correct information is Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14653; (800) 255-3434.

The correct telephone number for Sydex, developer of Con>Format (First Looks, *PC Magazine*, June 27, 1989, p. 48), is (408) 739-4866.

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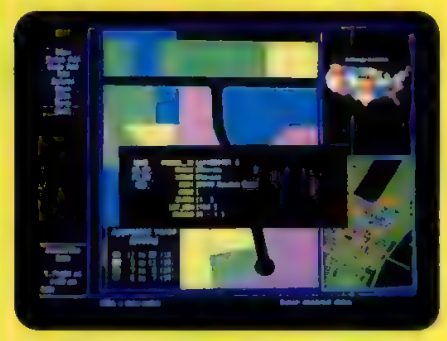

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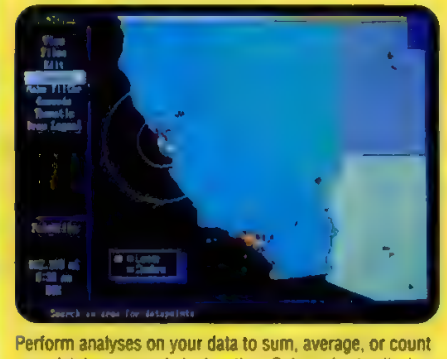

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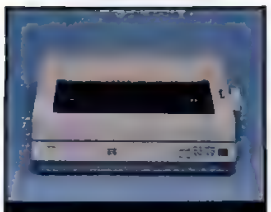

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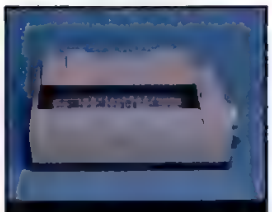

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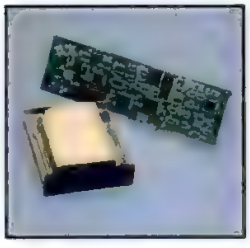

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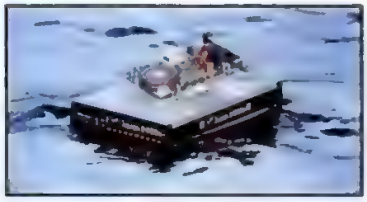

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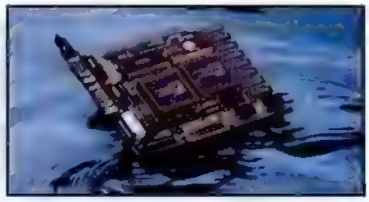

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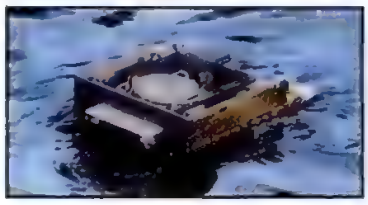

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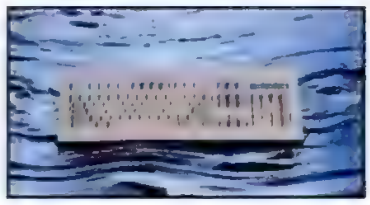

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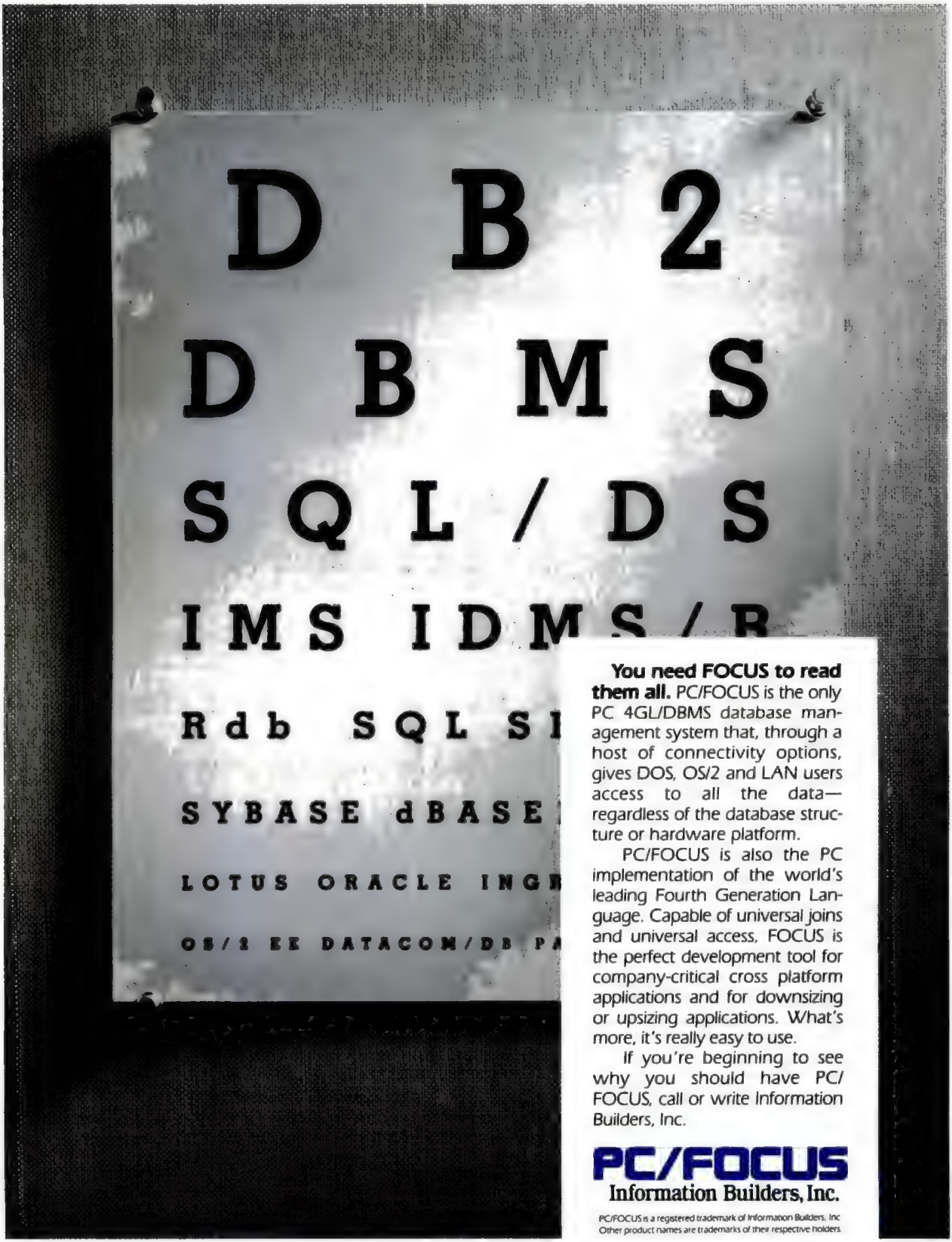

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CIRCLE 244 ON READER SERVICE CARD

by Lori Grunin

Advisor

AUTO-REBOOT

I would like to find a program that can be inserted into batch files to cause the computer to reboot automatically. Any recommendations?

Andrew Magee-Davey
Burlington, Ontario
Canada

There are probably a lot of little routines floating around that do this, but the one I found—REBOOT2.COM—resides in the Utilities Database on PC MagNet. (See the "By Modem" sidebar in the Utilities column to learn how to download data.) This 2-byte utility simply triggers interrupt 19, the BIOS's bootstrap loader routine.

PLOTTING WITH A LASERJET

Many of the competitors of the HP LaserJet line of printers advertise compatibility with HPGL as an extra feature. Do you know a font cartridge or soft font package that adds HPGL to the HP LaserJet?

Tony Sherfinski
Schofield, Wisconsin

Ironically, Hewlett-Packard chose not to include an emulation of its own Graphics Language in the LaserJet series of printers, despite the fact that many users like the clarity and flexibility of HPGL's vector-based images or just want faster draft output from their CAD packages.

Given a choice between HPGL software emulation and the one HPGL emulation cartridge available at this time, you'll probably want the $395 Plotter in a Cartridge from Pacific Data Products (6404 Nancy Ridge Dr., San Diego, CA 92121; (619) 552-0880). It not only provides faster HPGL-emulation printing, but can also speed up printing of PCL-based graphics. However, you need a minimum of 1.5MB of memory in your laser printer.

A review of Plotter in a Cartridge appears in First Looks in the June 27, 1989, issue of *PC Magazine*.

- AUTO-REBOOT: Initiating a soft reboot from within a batch file.
- PLOTTING WITH A LASERJET: Coaxing HPGL output from your HP LaserJet.
- CONTROL YOUR FLOPPIES: Adding a controller to break the two-floppy barrier.
- BEYOND COM2: Getting around the two-COM-port limit.

CONTROL YOUR FLOPPIES

My Compaq Deskpro 286 contains both a 360K drive and a 1.44MB drive in addition to the 1.2MB A: drive and the hard disk. Right now, I have no way of accessing all three drives at the same time. Can you recommend any controller cards that I can add to my system to support three floppy disk drives and a hard disk?

Brian Thompson
Dallas, Texas

Unlike that of the original PC, which supported up to four floppy disk drives, most controllers shipped with today's computers support only two floppy disk drives in addition to two hard disk drives. Therefore, adding a third floppy to your system requires getting a second controller to support it, even though you haven't exhausted the capacity of your original controller.

Luckily, floppy disk drive controllers are relatively inexpensive. Northgate's Universal Floppy Disk Controller, which lets you add two drives to your configuration, costs only $59 (four-drive model, $119; 13895 Industrial Park Blvd., #110, Plymouth, MN 55441; (800) 548-1993, (612) 553-0111).

Micro Solutions also offers a two-drive controller, the $95 CompatiCard II (132 W. Lincoln Hwy., De Kalb, IL 60115; (815) 756-3411). The CompatiCard II supports only internal floppies; if you have external drives, then you need the four-drive CompatiCard I ($125), which will support an external floppy disk drive.

A review of both drives appears in First Looks in the June 27, 1989, issue of *PC Magazine*.

BEYOND COM2

I've been stumped by IBM's design limit for serial ports. I'd like to add a COM3 and COM4 beyond the two already installed in my 386 clone. I put the new board in and properly set the jumpers, but when I attempted to set the communications parameters via DOS's MODE command, I got "illegal device" error messages.

I've looked for books to tell me how to get around this problem, but to no avail. Is there a software driver that I must install to effect valid operation of these ports?

Thomas Emery
Goleta, California

IBM's original PC architecture supported only two COM ports, and although compatible makers, and eventually IBM, added more serial capability, there are still no standard addresses or IRQ (Interrupt Request) lines for the additional ports.

The addresses for COM1 and COM2 are 3F8h and 2F8h, respectively, with COM1 on IRQ4 and COM2 on IRQ3. When you install more serial ports, COM3 usually uses 3E8h and IRQ4, while COM4 uses 2E8h and IRQ3. Unfortunately, some I/O card makers like to blaze their own trails; IBM even added uncommon COM port addresses and IRQs to the long list of PS/2 eccentricities.

The DOS MODE command doesn't work with serial ports above COM2 be-

cause DOS gets its I/O information from the BIOS, which finds out what's installed where in your system during the Power-On Self-Test (POST). The POST checks only for the first two installed ports.

To get around this problem, communications software and some serial peripherals (such as mice) will occasionally support higher COM ports by addressing them directly, rather than making DOS function calls. Of course, if your peripherals don't support these extra ports or you need to redirect data using the MODE command, that's where trouble arises.

There are a couple of public-domain utilities that allow you to append your COM port information to the BIOS, making the ports DOS-accessible. COMSET (COMSET.ARC) and Port Finder (PF2.ARC) are available in the "general hardware" data library of the IBMHW forum on CompuServe; Port Finder can also be obtained from its author, mcTRONic Systems (7426 Corwall Bridge Ln., Houston, TX 77041; (713) 462-7687).

Both packages activate COM3 and COM4 (if they're installed, of course), and require DOS 3.3 or later. They basically do two things: activate the extra ports by giving the BIOS the addresses, and provide utilities for swapping the addresses among the different ports. Address-swapping allows programs that don't support COM3 and COM4 to access them. Software that directly addresses the ports will usually be unaffected.

DOS gets its I/O information from the BIOS, which finds out what's installed during the POST.

Keep in mind, however, that you probably won't be able to swap two ports that share an IRQ (such as COM1 and COM3) if you've got a mouse attached to one of them, because the system will get confused when the interrupt triggers.

Port Finder is the more flexible of the two. In addition to the aforementioned features, it provides the same capabilities for LPT3, including swapping among printer ports. Furthermore, it lets you easily restore all your original settings.

Even if you think you've correctly configured the board, it can't hurt to double-check a couple of things. If you've got a bus mouse, for instance, make sure that you're not stepping on its IRQ; although interrupt sharing is one of the touted features of the PS/2, PCs can't do it very well.

Also, don't leave any port holes—if you've got three, they should be COM1, COM2, and COM3, not COM1, COM2, and COM4.

ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column for access information). Please specify your equipment. ■

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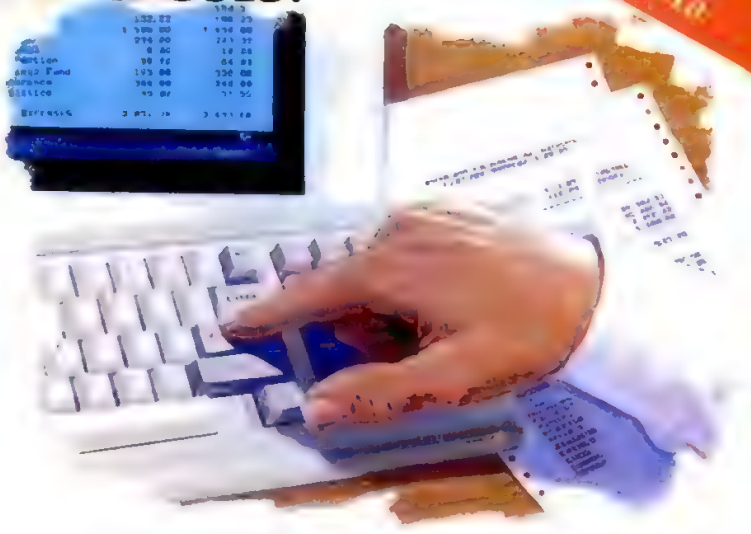

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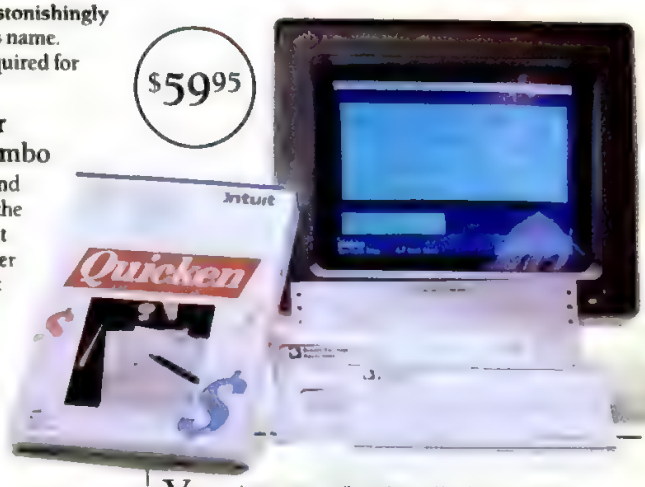

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CIRCLE 272 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

HP's NewWave Offers a More Natural Way of Working with Documents

HANDS ON
by Charles Petzold

Even if Hewlett-Packard were never to sell a single copy of its *HP NewWave Environment*, the product is still destined to have a profound influence on the evolution of the graphical user interface. What *NewWave* does is difficult to understand at first because it is very different from the way in which we currently use our PCs. *NewWave* requires a paradigm shift, a change in our perceptions of the relationship between applications and documents.

NewWave runs under *Microsoft Windows*. The $195 program doesn't subtract from anything you can do under *Windows*, but instead extends the environment in various ways for both the user and the program developer.

After installing *NewWave* and running the batch file that starts it up, you are greeted by the NewWave Office, which displays a collection of icons.

Most of these icons will be document files. The icon itself represents the application that created the document; the text underneath the icon is the name of the document. By clicking one of these icons with a mouse, you invoke the application. The application, in turn, loads the document, which is then ready for use.

The program comes with a sample *NewWave* application—a WYSIWYG word processor called *NewWave Write*. This is a more sophisticated word processor than *Windows Write*, which is included with *Microsoft Windows*. It offers, for example, a spelling checker and a page preview mode.

Just as *Windows* is best suit-

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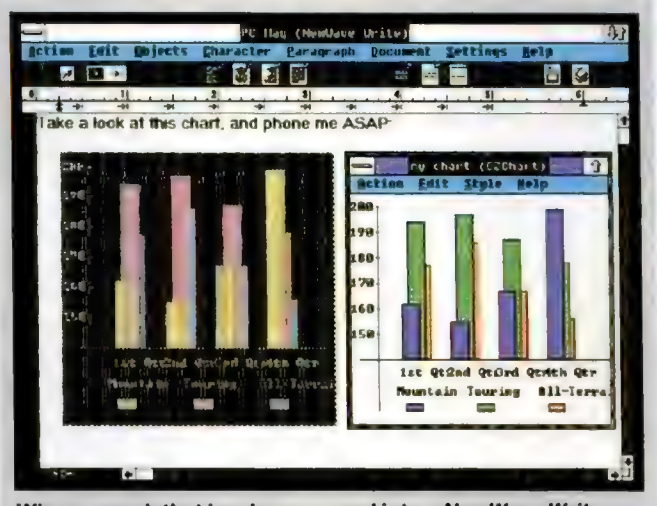

When a graph that has been moved into a *NewWave Write* document is selected, the application that created the graph appears. You can then change the graph with the graph program, and the graph in the *NewWave Write* document will change accordingly.

October 17
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Finesse Provides High-End DTP Functionality for a Mere $179

HANDS ON
by Luisa Simone

They said it couldn't be done: nobody could design a desktop publishing product for the average businessperson that combined high-quality output and powerful, but easy-to-learn, tools. But Logitech's *Finesse*, with some help from Bitstream and Digital Research, proves those naysayers wrong.

Bitstream provides *Finesse* with four high-resolution, scalable fonts in the form of the Bitstream Fontware Installation Kit. Digital Research provides a runtime version of *GEM Desktop*, which is fast becoming the graphical environment of choice for low- and midlevel DTP programs. The rest comes from Logitech.

Finesse itself contains all the features you would expect a DTP program to offer: text and graphics frames, rules, varying column widths, the ability to import files from the major word processors, bitmapped art, and text and paragraph formatting.

But it also contains a host of things you've learned not to expect from an entry-level program that costs only $179. You can link text frames in order to jump a story from page to page. You can see accurate representations of downloadable fonts on-screen, because *Finesse* uses both the printer and screen fonts created by Bitstream. You can have a ridiculously high number of columns on a page, because columns function merely as

CONTINUES ON PAGE 34

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FINESSE

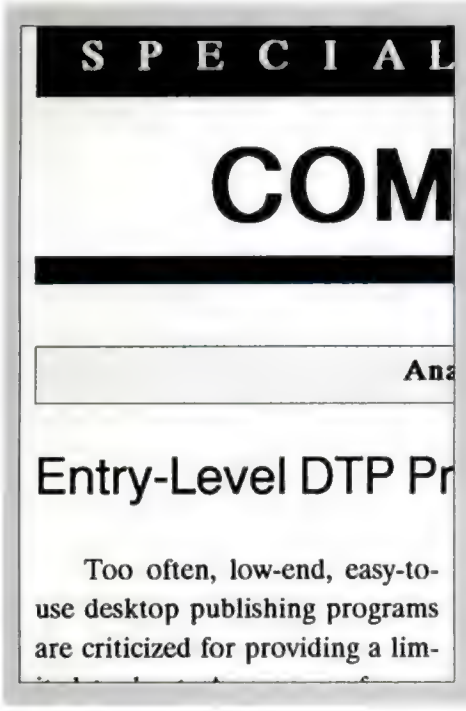
CONTINUED FROM PAGE 33

guides for the text frames. Varying the column widths is as simple as extending a text frame across column guides. You can choose to have *Finesse* automatically hyphenate your copy to match the column width. You can create paragraph formats and copy them to subsequent text blocks as well.

Add to those features a search-and-replace function, a one-line context-sensitive help display that sits at the bottom of the screen, the ability to create master pages with headers and footers, manual kerning of display type, and automatic page numbering, and you'll begin to understand why *Finesse* is so useful. Even more important, all of this functionality is easily accessible. For example, to enable the program's automatic page-numbering feature, all you do is click on an icon in the toolbox when you prepare master pages.

When you fill a text frame with a solid black background (as shown in the reverse banner), *Finesse* assumes that you want the text to be white.

Most entry-level DTP programs allow you to import art, but they limit bitmap images to a low resolution of 72 dots per inch. *Finesse* gives you access to high-quality images, accepting GEM's internal vector-based art format. And you can import TIFF files with resolutions as high as 300 dpi. A clip-art sampler that comes with the program includes 70 TIFF files at 200 dpi. *Finesse* even has a menu option that, if you use Logitech's ScanMan hand-held scanner, allows you to scan and manipulate images.



Unlike many other entry-level DTP programs, *Finesse* allows you to see accurate representations of downloadable fonts on-screen.

Several smaller features also deserve praise. If a text frame is too small to display all of the copy associated with a story, *Finesse* alerts you with a small red arrow, saving you from printing out a document only to discover that part of the story is missing. Such common-sense design decisions show up time and again throughout *Finesse*. When you fill a text frame with a solid black background, for example, *Finesse* quite logically assumes that you want the text to be white.

When you create a text or graphics frame, the options box under the toolkit automatically lists the various file formats that *Finesse* will import. Click on a format and the program brings up the file import dialog box. And creating fills for boxes, or selecting reverse type, is so effortless that you don't even have to read the manual.

For all its merits, *Finesse* does have limitations. Some, like the fact that you have only nine fill patterns from which to choose, are negligible. You can get around the program's 16-page document size limitation by dividing a big project into sections and using the automatic page-numbering feature to start the second section at page 17.

The program's text-formatting features could also bear improvement. For example, a cursor seems to count as a character, with the result that if you inadvertently click on a small text frame while a large typeface is selected as the default, you will see a red arrow indicating extra type—even if you don't enter any text. *Finesse* will not let you correct the size of the cursor; you must "empty" the box using the delete key before you can enter text.

In addition, the program performs erratically when you attempt to change the default typeface, sometimes maintaining the previous typeface selection when you've actually changed the spec.

Also, it's difficult to size imported graphics, in part because *Finesse* distorts the aspect ratio of the page on all VGA screens—making it very difficult to judge the proportions of an image accurately.

The strangest problem I encountered was that mouse positioning was inaccurate on occasion. This is surprising because Logitech is best known as a mouse manufacturer—and because I was using a Logitech mouse.

It would also be helpful if the program indicated the cursor position on the displayed rulers, and if, when copying a master right page to a master left page, it mirrored the format so that the folio was always on the outside column. But that's asking for perfection in a new product. When near-perfection costs only $179, you should rush out and buy it. And that's what you'll find in *Finesse*. ■

FACT FILE

Finesse
Logitech Inc., 6505 Kaiser Dr., Fremont, CA 94555; (415) 795-8500.
List Price: $179
Requires: 640K RAM, hard disk, DOS 2.1 or later (in conjunction with the Bitstream Fontware Installation Kit, DOS 3.1 or later).
In Short: With the ability to link text frames, import TIFF files, hyphenate text, and fully utilize downloadable fonts, this inexpensive DTP program is a steal. It includes a runtime version of *GEM Desktop* and the Bitstream Fontware Installation Kit.

CIRCLE 434 ON READER SERVICE CARD

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NewWave

CONTINUED FROM PAGE 33

ed to running applications written to the *Windows* API (application program interface), *NewWave* is best suited to running applications written to the *NewWave* API. Programs written for *NewWave* are basically *Windows* applications that have been modified to take advantage of special *NewWave* features. Over the next 3 to 9 months, several *NewWave* applications are expected to be released, including versions of *Microsoft Excel*, Micrografx's *Graph Plus*, and Samna's *Ami*.

What can you do in *NewWave* that's so special? The following examples, based on *NewWave* programs created for demonstration purposes, will give you an idea of what you'll be able to expect from *NewWave*-aware applications.

Suppose that you begin by creating a word processing document in *Ami* and then decide to include a small spreadsheet from *Excel*. Using the clipboard, you copy the spreadsheet from *Excel* into the *Ami* document. You then decide to include a bar graph from *Graph Plus*, so again you use the clipboard to transfer it into the document. This is basic stuff that you can do in *Windows* today.

But here's the *NewWave* difference: While still in *Ami*, you can select the spreadsheet that you've moved into the document and *Excel* will spring into life, containing the spreadsheet. You can then make changes to numbers or formulas or formatting, and the spreadsheet that you've moved into the *Ami* document will change also. You then select the bar graph and the *Graph Plus* window appears. You can change the bar graph to a line graph and the graph in the *Ami* document changes also.

Of course, this seems a very natural way to work with documents, yet it is very unlike anything we can do with PC applications today. Normally, after a spreadsheet or graph is moved into a word processing document, it loses all connection with the application that created it. In *NewWave*, the spreadsheet and graph that are moved into the document are still linked to the original applications. This is how *NewWave* can invoke the application when you select the spreadsheet or graph in the document.

You can print a document simply by using the mouse to drag the document icon to the printer icon in the NewWave Office. As *NewWave* prints the document, all three applications are transparently invoked to carry out their specialized tasks; *Ami* is responsible for printing the text part, *Excel* for the spreadsheet part, and *Graph Plus* for the graph part.

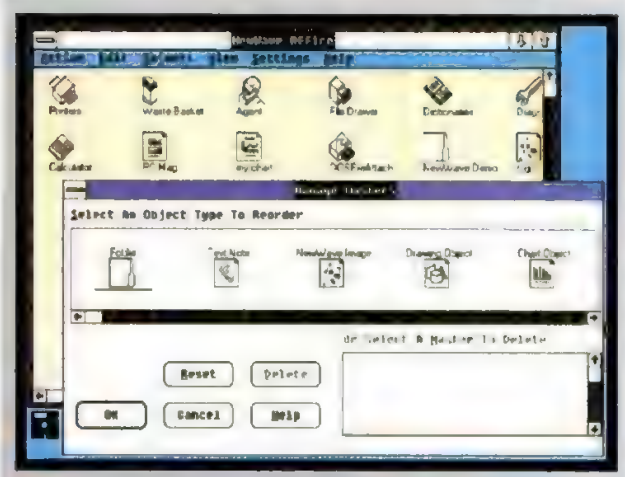
In short, *NewWave* extends object-oriented concepts into the relationship between applications and their documents. The document becomes an object; the applications (using object-oriented terminology) are the "methods" that allow you to manipulate various parts of this object. The benefits to the user are obvious: You can focus your attention on the documents rather than on the applications that create them. Each *NewWave* application that contributes to a document is seamlessly invoked to handle what it does best.

It is also possible to configure *NewWave* so that existing DOS or *Windows* applications will show up as icons in the NewWave Office. Hewlett-Packard calls this process "encapsulation." This allows users to take advantage of some *NewWave* facilities in using these programs. Encapsulation requires the *NewWave Support Pack*, available for $145. Corporations that choose to use *NewWave* only need one *Support Pack* for the local PC coordinator, who would assist *NewWave* users in configuring their systems.

NewWave also includes some other goodies that applications can use, such as a built-in on-line help system, a computer-based training system, and (although limited in the initial release) a task-automation facility. Full-blown *NewWave* application programming requires the $895 *NewWave Developer Kit*, in addition to the *Microsoft Windows Software Development Kit* and a C compiler.

It is difficult to predict how commercially successful *NewWave* will be. A corporation that makes a commitment to using *NewWave* must also make a commitment to *Microsoft Windows;* software developers who write *NewWave* applications will be those who also write *Windows* applications. It could very well be that the next couple of years will see more attention focused on converting *Windows* users and programs to the OS/2 Presentation Manager rather than to *NewWave*. Hewlett-Packard expects to adapt *NewWave* for the Presentation Manager, but it's not yet certain when this will be ready.

Still, *HP NewWave Environment* offers such an obvious enhancement to the graphical user interface that it simply cannot be ignored. *NewWave* is going to be a highly influential product in guiding the future course of software. ■



The primary user interface of the *HP NewWave Environment* is NewWave Office, shown here with one of its dialog boxes.

Because *NewWave* runs under *Windows*, you can use all of *Windows'* facilities with *NewWave*, as shown by the MS-DOS Executive and the NewWave Office.

FACT FILE

HP NewWave Environment
Hewlett-Packard Co., Personal Software Division, 3410 Central Expwy., Santa Clara, CA 95051; (800) 752-0900.
List Price: $195
Requires: 4MB EMS 4.0 expanded memory, hard disk, *Microsoft Windows/286*
In Short: By bringing object-oriented concepts to applications and to the documents they create, the *HP NewWave Environment* demonstrates the next major advancement in graphical user interfaces.

CIRCLE 445 ON READER SERVICE CARD

$1,495 HP LaserJet Series IIP: The Laser Printer For the Rest of Us?

by Alfred Poor

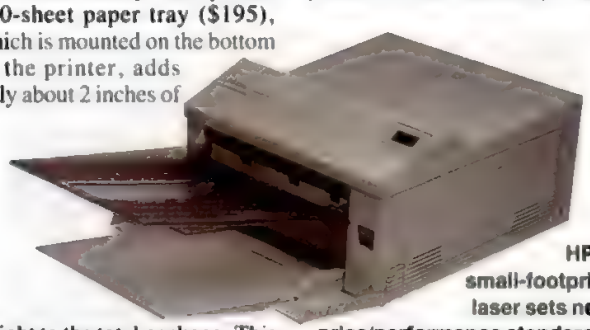
Once again, Hewlett-Packard has redefined the printer market. This time it's with the HP LaserJet Series IIP, a 4-page-per-minute printer with a list price of $1,495 (the street price is probably $1,000 or lower). The IIP is likely to become the standard by which all low-end laser printers are judged.

Aside from price, the most obvious difference between the IIP and its predecessors is size: the unit takes up a bit more than a square foot of desk space and is only 8 inches tall. The small size is possible through the use of a new Canon laser engine, the P110.

In effect a slower and less weighty version of the Series II ($2,695), the 25-pound IIP uses the same command set, has the same 512K memory, uses the same soft fonts and font cartridges (though it has one slot instead of two), and gives you the same excellent 300-dot-per-inch print output. You get the same choices of faceup or facedown output and parallel or serial connections.

The IIP even offers some improvements over the Series II. It comes with more portrait fonts; you get medium, bold, and italic Courier in both 10 and 12 pitch, plus Line Printer. And like the larger Series IID ($4,295), it can automatically rotate all fonts to landscape orientation. The front panel uses raised buttons with clear legends.

The IIP has two memory card slots that can take up to 2MB each, giving you a total add-on capacity of 4MB. That's enough to handle complex graphics and lots of downloaded fonts. Unlike with earlier LaserJets, you can download and use as many fonts per page as you can fit in memory. An optional 200-sheet paper tray ($195), which is mounted on the bottom of the printer, adds only about 2 inches of height to the total package. This option gives you access to both trays.



HP's small-footprint laser sets new price/performance standards.

Paper handling is perhaps the weakest aspect of the IIP. Most users will probably buy the optional paper tray right off the bat, because without it you must rely on a stacking paper bin that holds only about 50 sheets at a time. And while the printer offers both faceup and facedown output, it doesn't have a straight-through paper path, which can limit the thickness and stiffness of the paper that will feed through the printer. (The manual specifies 28-pound paper as a maximum for the unit.)

When it comes to performance, the IIP is surprising. In the PC Labs text speed test, it came close to its rated speed by posting a 3.9-page-per-minute result. This is only a page or so slower than a number of more expensive 6-ppm printers. And with a 53-second time in the graphics test, it surpassed many higher-priced competitors.

The user manual is full of illustrated explanations on setup, maintenance, font control, and front-panel operation. Two tear-out reference cards cover PCL and the front-panel-configuration menu options. The best news comes in the *Software Application Notes* manual; you get about 150 pages of dense, detailed information on how to make the printer work with *dBASE III Plus*, *Lotus 1-2-3*, *Microsoft Word* 5.0, *MultiMate Advantage II*, *Professional Write* 2.02, *WordPerfect* 5.0, and *WordStar Professional* 5.0.

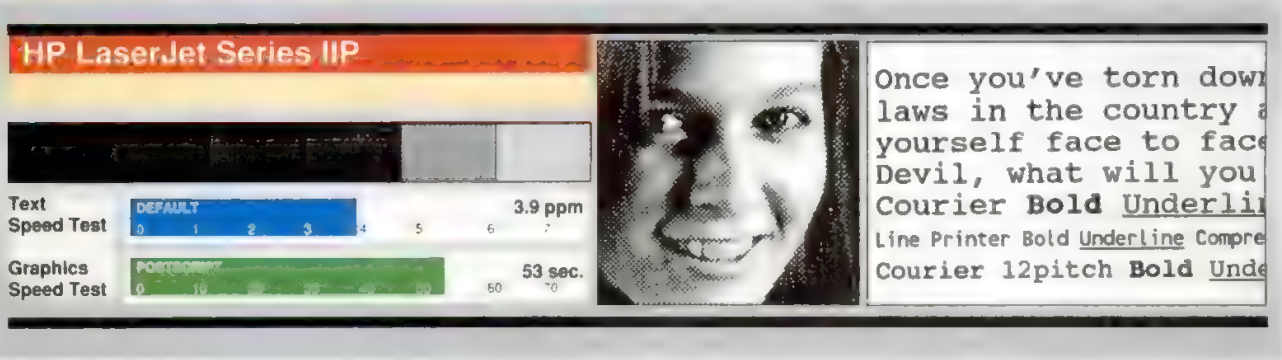
Setup could not be easier. Like the other LaserJets, the toner, drum, developer, and other consumable components are all contained in a single cartridge that's rated for 3,500 pages, but if history repeats itself, it's likely that HP's specifications are quite conservative. The front of the printer case opens up, and you just slide the cartridge into place. Close the hatch, power up, and you're almost ready to go—*almost* because the self-test procedure produces a "cleaning paper" that you run through again facedown to remove any excess toner that may be on the paper transport rollers.

If you have to pay list price and can't afford a faster printer like the original Series II, the IIP is an attractive value. And if you've been considering an expensive 24-pin printer, you might find that the IIP's street price is well within the limits of your budget. ■

FACT FILE

HP LaserJet Series IIP
Hewlett-Packard Co., 3000 Hanover St., Palo Alto, CA 94304; (800) 752-0900.
List Price: $1,495; optional paper tray, $195; 1MB memory card, $495; 2MB memory card, $995
Dimensions: 8.25 by 13.68 by 27.5 inches (HWD)
Weight: 25 pounds.
Emulations: LaserJet Series II (with extensions).
In Short: A slower, less weighty version of the HP LaserJet Series II, this 4-page-per-minute laser printer offers rotatable fonts, two expansion slots, parallel and serial ports, and much more. Its low price brings laser printing within the reach of people who would normally consider buying an expensive 24-pin dot matrix printer.

CIRCLE 444 ON READER SERVICE CARD



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Feature-rich PC Paintbrush IV Handles High-Res Images, Outline Fonts

HANDS ON
by Luisa Simone

Once you've grown accustomed to creating smooth Bezier curves with vector-based illustration software and high-resolution output with PostScript, it's easy to forget how much fun using a bitmapped paint program can be. Z-Soft's *PC Paintbrush IV* will refresh your memory. With the ability to display 256 on-screen colors, versatile text-handling capabilities, and a range of special effects, the program establishes a new level of sophistication for low-end paint programs. It's hard to believe that a mere $99.95 will buy you this much functionality.

PC Paintbrush IV does a good job of converting solid colors displayed on-screen into black-and-white output.

PC Paintbrush IV supports a host of video modes (CGA, MCGA, Hercules, EGA, VGA, and Super VGA), offering you a list of 162 video adapters from which to choose the color combinations and resolutions that are right for your images. For example, rather than sticking with the standard VGA mode of 640 by 400 resolution and 16 on-screen colors, you can opt for a resolution of 320 by 200 and a palette of 256 colors or shades of gray, which is what you'll need for manipulating or retouching photographic images. Other drivers, like the one for the Taxan Crystal View monitor, let you kick up the resolution to 1,280 by 960. The program's ability to import and export .TIF files should make its high-resolution imaging capabilities all the more attractive to desktop publishers.

However, *PC Paintbrush IV* is constrained by its inability to take advantage of expanded or extended memory. Forced to work within DOS's 640K limit, the program struggles to create high-resolution images larger than 1.5 inches square. As a result, when you enlarge a high-res image (and thus enlarge the individual dots) by more than twice its original size, you are sometimes left with coarse, unappealing dot patterns.

PC Paintbrush's SAA-compliant menus give you control over screen configuration and various special effects. For example, you can modify the screen layout to hide the various status and help lines that normally appear. You can create and save customized palettes. And you can easily access statistics about memory usage. The special effects menu offers such options as gradient fill, blending, tinting, and contrast control, all of which allow you to paint some very sophisticated pictures using simple tools.

The tools may not be complex, but you'll still need to spend a good deal of time experimenting with them before you know what combinations of paintbrush type and special effects work best. For example, I found *PC Paintbrush*'s gradient fill to be rather crude until I used it in conjunction with the program's smudge and blending features. (Unfortunately, you cannot customize the shape or size of a paintbrush but must choose from among seven supplied brush types.) It also helps to choose the Solid Colors Only option from the display menu if you're planning to print your graphic in black and white, since dithered colors are more difficult to translate.

The program's new split screen, which divides your display into a pixel-editing window and a full-image window, is a beneficial addition that affords you control over the fine details of your image. Almost as quickly as you edit the magnified portion of an image in the pixel-editing window is your change reflected in the full-image window. You can also reduce the size of an image that's too large to be displayed on-screen and can specify the factor by which you want to magnify or reduce an image.

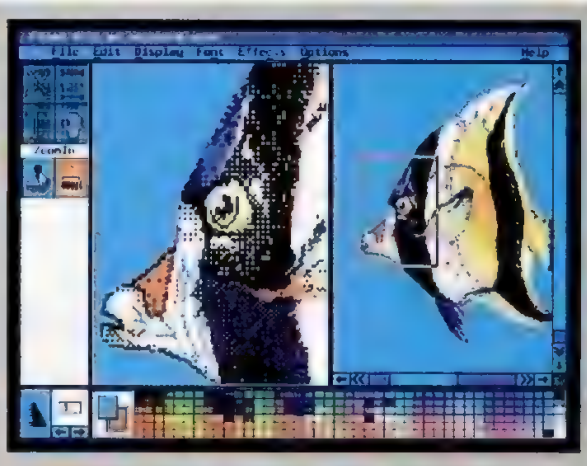
This new release also deserves praise for its inclusion of outline fonts, and for the way it lets you add text to a painting. The dialog box in which you enter text is nothing special. But once you've moved your text into a painting, the text becomes an editable image, as long as it is surrounded by a gadget box. Thus, you can change the type attributes, including size, placement, shadow, boldfacing, and color treatment. And you can even edit the text itself by clicking on the text tool again.

If you can live with the program's memory limitation, you'll find that its painting tools, special effects, and file importing/exporting capabilities are amazing for the price. ■

FACT FILE

PC Paintbrush IV
Z-Soft, 450 Franklin Rd., #100, Marietta, GA 30067; (404) 428-[illegible]
List Price: $99.95
Requires: 640K RAM, graphics adapter, mouse, DOS 2.1 or later.
In Short: With higher screen resolutions, special blending effects, and more colors than ever, *PC Paintbrush* establishes a new level of sophistication for low-end paint programs. New-found abilities to handle outline fonts and .TIF files make this program a useful adjunct to DTP programs.

CIRCLE 433 ON READER SERVICE CARD



***PC Paintbrush IV*'s split-screen editing window lets you see how each pixel-level change affects the entire image.**

Now you can change programs on your computer just as easily.

"Click", spreadsheet.
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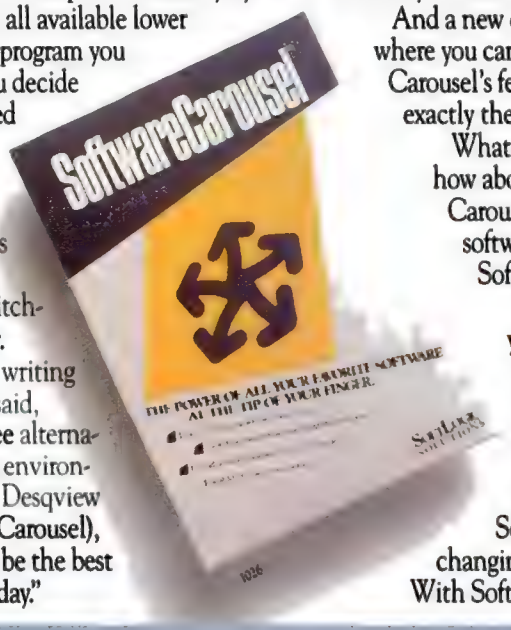

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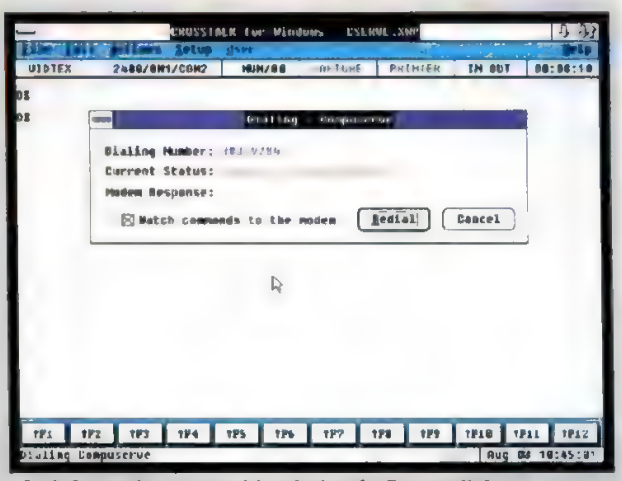
Crosstalk for Windows Offers Powerful Script Language, Attractive Interface

HANDS ON
by Barry Simon

Crosstalk XVI and *Crosstalk Mk.4* users who want to explore what *Microsoft Windows* has to offer without having to learn an entirely new communications scripting language can do so with DCA's *Crosstalk for Windows*. The $195 program ($95 for registered owners of *Crosstalk XVI* and *Mk.4*) is one of several recently released communications programs for *Windows*, including *Dynacomm* 2.0 from Future Soft and *Ape* from Hi-Q International.



An informative, moveable window in *Crosstalk for Windows* tracks the status of file transfers.

At first glance, the usefulness of *Windows* for communications programs may not be as apparent as it is for graphics programs and WYSIWYG word processors—but it is real. For example, *Windows'* scroll bars and point-and-click conventions are naturals for dealing with on-line capture buffers. The mouse pointer environment makes it possible to have on-screen buttons that send text or invoke scripts, and *Windows'* elegant dialog boxes are well suited to getting input during script execution. And if you've ever had information about a file that was being transferred from a host obscured by your communications program's information windows, you'll appreciate *Windows'* ability to move such obstructions.

Then, too, there is DDE (Dynamic Data Exchange), the *Windows* protocol for sharing and exchanging data between *Windows* applications. For example, you could use the DDE support built into *Crosstalk for Windows* and the other two *Windows*-compatible communications programs to move mainframe data into a *Microsoft Excel* spreadsheet by having an *Excel* macro invoke a script.

One weakness common to all *Windows* communications programs is really a limitation of *Windows* itself—that the environment only supports Comm1 and Comm2, not Comm3 or Comm4. As you'd expect given its parentage, *Crosstalk for Windows* has strong file-transfer support, including Xmodem, Zmodem, and CISB (for CompuServe and PC MagNet), although it lacks *Crosstalk Mk.4*'s ability to add protocols via external files.

The program also has a full-blown Kermit processor, including remote directory and type commands as well as those for send and receive. Supported terminal emulations include VT 52/102, IBM 3101, VIDTEX, and ANSI-PC, but not VT 220, which is supported by *Ape* and *Dynacomm*. In addition, the program has a well-implemented phone book and works with the editor of your choice.

Crosstalk for Windows enhances the *Windows* interface in several ways. When the program runs in background mode, an icon will show you how much of the upload or download has been completed. If you want to change a parameter like the baud rate, you can do so with the mouse.

The program accepts user input via the usual dialog boxes, radio buttons, list boxes, and push buttons. However, the program does not provide *Windows*-type menus and file-choice list boxes, nor does it offer you the ability to use icons in messages and dialog boxes.

You can scroll back *Crosstalk for Windows'* terminal window, but the procedure is awkward. You have to hit ScrollLock or double-click on the time display to show the scroll bars, at which point you can use your mouse or PgUp or PgDn to scroll back. Before you can enter additional text to the host, you have to hit ScrollLock or double-click to get out of scroll mode.

The program has a rich script language loosely based on CASL (Crosstalk Application Script Language), which is one of the hallmarks of *Crosstalk Mk.4*. Because the two implementations differ, complex CASL scripts created in *Crosstalk Mk.4* may not be directly usable by *Crosstalk for Windows*, but simple scripts will be usable. Most significant, *Crosstalk for Windows'* program flow is missing the CASL support for case statements. You'll have to replace those with repeated if-else statements. In addition, *Crosstalk for Windows* lacks CASL's support for real numbers and arrays.

Crosstalk for Windows compiles scripts for later execution. The syntax checking of the compiler is limited, so you get runtime errors while you are on-line. Both *Dynacomm* and *Ape* caught the misspelling of the word "second" at the syntax-checking level, while *Crosstalk for Windows* did not. *Crosstalk for Windows* also lacks *Dynacomm*'s memory for names, so you have to move through a list box to pick a just-edited script for compiling.

Crosstalk for Windows comes with a Learn script mode that will record an on-line session into a script. This feature is not perfectly implemented, however; you must click on a button when you want to send a string, and if you try to record both a log-on and a log-off script in one session, you'll discover that your log-on script has been overwritten.

A powerful program with a robust script language and an attractive user interface, *Crosstalk for Windows* will delight *Windows* users who are looking for a communications program and non-*Windows* users who want to explore graphical interfaces. Current *Crosstalk* users are likely to find DCA's $95 special offer irresistible. ■

FACT FILE

***Crosstalk for Windows*, Version 1.0**
Digital Communications Associates Inc., Crosstalk Communications Division, 1000 Holcomb Woods Pkwy., #440, Roswell, GA 30076; (404) 998-3998.
List Price: $195; $95 for registered owners of *Crosstalk XVI* and *Crosstalk Mk.4*.
Requires: *Microsoft Windows* 2.10 or later (runtime not included), mouse strongly recommended
In Short: A communications program that runs under *Microsoft Windows*. Offers background communications, a powerful script language, and an attractive graphical interface.

CIRCLE 447 ON READER SERVICE CARD

FastLynx: Successor to Fastwire II Features Improved Performance, Remote Installation

HANDS ON
by Rock Miller

Time waits for no product, especially in the fast-moving market for file-transfer software. So it's not surprising that Rupp Corp. has not rested on its laurels. *FastLynx*, its $149.95 successor to *Fastwire II*, not only matches the best of the competition, but does so with exceptional flair.

To *Fastwire*'s already full set of features, *FastLynx* has added a number of competitive enhancements, including the ability to upload the program to a remote machine over a serial link, as well as a set of virtual device drivers for sharing the drives and printers of a remote workstation. It is also better packaged, with longer and higher-quality cables.

FastLynx offers a significant boost in performance over its predecessor, especially on small-file transfers. It now stacks up extremely well against the competition, proving a good deal faster than *LapLink III* and keeping pace even with *The Brooklyn Bridge*'s speedy parallel mode. It especially excels on serial transfers, which are conducted over a 7-wire cable.

The most noticeable improvement, however, is *FastLynx*'s cleaner design. Though the program still uses a master/slave approach, you needn't permanently designate one machine as the slave. Instead, once you start working on one machine, the other switches into slave mode automatically. You can easily reverse the relationship simply by starting to work at the slave machine. Including its help file, *FastLynx* takes up about 178K of disk space on each machine.

One of *FastLynx*'s nicest touches is that you don't need to configure it. Installation is simply a matter of copying files to your hard disk, and once it's up and running, the program scans all of the parallel and serial ports in your machine until it can make a connection. Though you have control over which ports to scan and other configuration options, in most cases you should never need to change them.

In appearance, *FastLynx* is very similar to its older sibling, with Novell-like menus that give it beautiful consistency, though at the price of some quirks, such as annoying error messages. But the port diagnostics (formerly a separate program) and the upload program are now on the main menu, and you can shift among the split-screen, form, and command modes with handy Alt-key shortcuts.

The split-screen mode retains its appealing simplicity, with nearly every operation accessible from a few function keys. You can now make and remove directories on both machines (though it still does not have a directory-tree display). A local copy option has also been added. Marking files and directories has been made easier, and you can now delete entire directories with their files in a single operation.

The program's short, well-written manual covers installation and troubleshooting. The details of using the program are left to the excellent on-line help system and its innovative on-line user guide. Though the latter (which takes up 56K of disk space) is a nice touch for laptop users, it's disappointing that Rupp has not added any text-search or indexing functions, which would make it more useful, as well as more convenient, than a printed manual.

Error handling is still an area in which *FastLynx* could stand a bit of improvement. The program works smoothly in general, but its error messages tend to be technical and uninformative; for example, if you overfill the root directory on the target, you get an unhelpful "Permission denied" message. And if you accidentally specify a nonexistent drive letter on the local system, your only option is to abort messily.

To supplement its flexible form and command modes, *FastLynx* now includes the Expansion Box, a set of programs and device drivers that let you use drives and printers on a remote computer as if they were on your own.

The Expansion Box is as trouble-free as *FastLynx* itself. After installing the device drivers in your CONFIG.SYS and AUTOEXEC.BAT files (which you can do directly from the server program), attaching a remote computer is as simple as running the server program on it. Like *FastLynx*, it scans the ports continuously, making the connection automatically when you change to one of the server's virtual drive letters.

Printer sharing is handled just as smoothly. The server's printer is used if it is on-line; if not, the program automatically shifts to the printer on the lead machine. The disk device driver takes about 7K of RAM (in serial mode), while the printer redirector takes about 3K more, and there are no pop-ups to interfere with your applications.

Elegant design and thoughtful attention to detail make *FastLynx* a standout in its crowded field. Though it's still on the high side of the price range and takes a fair amount of disk space, it gives you in return a powerful and flexible program that is nevertheless remarkably easy to use. ■

***FastLynx*'s Upload feature, like *LapLink III*'s Remote Install, lets you send the *FastLynx* files to a remote computer over the serial cable.**

FACT FILE

FastLynx
Rupp Corp., 7285 Franklin Ave., Los Angeles, CA 90046; (213) 850-5394
List Price: *FastLynx Deluxe* (includes parallel and 7-wire serial cables, software on 3.5- and 5.25-inch floppy disks, and manual), $149.95; additional parallel or serial cables, $39.95 each.
Requires: 190K RAM, parallel or serial port on each computer, DOS 2.0 or later
In Short: *FastLynx* is a big jump up from its predecessor, *Fastwire II*, in both performance and features. Design improvements have moved this program to the head of its class; *FastLynx* offers great flexibility in a smooth, intelligently organized package.

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* EDITOR'S CHOICE 9/15/86

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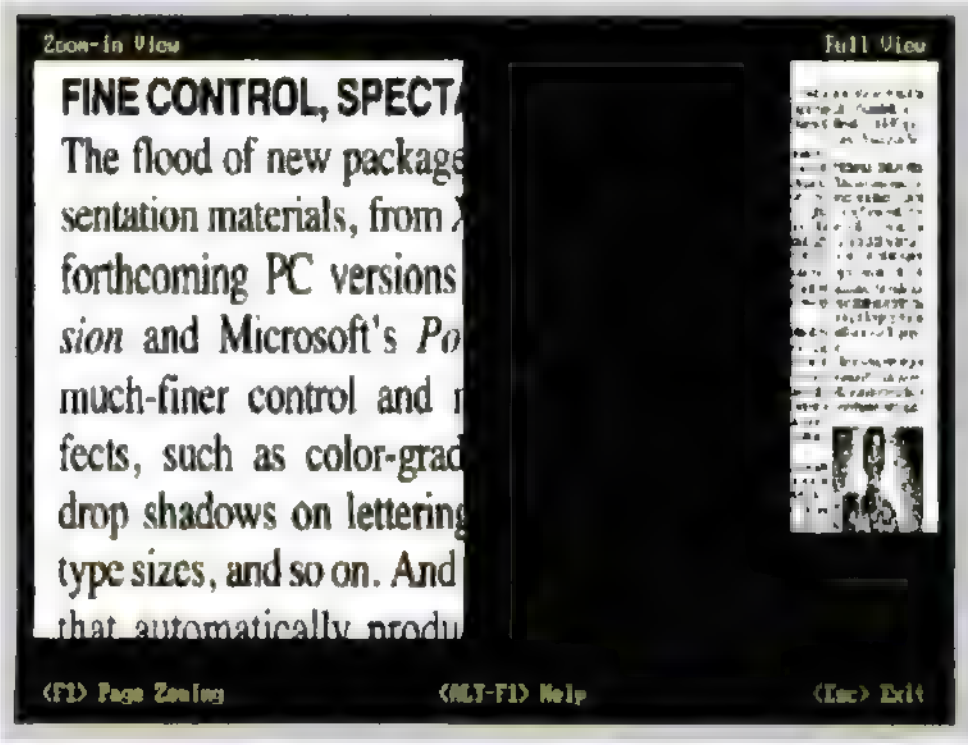
CIRCLE 281 ON READER SERVICE CARD

CAT Reader: Trainable OCR Software Requires Patience and a Steady Hand

HANDS ON
by Lori Grunin

If you're thinking of buying a hand scanner, you'll soon be hearing a lot about optical character recognition (OCR); several hand-scanner makers, including Nisca, The Complete PC, and KYE International, have bundled a version of Computer Aided Technology's $295 *CAT Reader* trainable OCR software with their products. Current hand-scanner users can jump on the OCR bandwagon now with CAT's original software.



The Page Zoning screen shows a zoom of a scan on the left; you choose a section for OCR from the overview on the right.

CAT Reader performs OCR on dot matrix, monospaced, and proportionally spaced print. It can scan either from top to bottom or left to right (with automatic rotation) and can merge a large block of text scanned in multiple passes.

CAT Reader controls scanning as well as character recognition. You scan in a passage in line-art mode at a resolution of 200 dots per inch. Higher resolution isn't an asset, since the software has a 300K limit on the size of an image. After scanning, *CAT Reader* saves the image in a .TIF file, then displays a magnified version next to a greeked overview. Zoom view allows you to check the quality of the scan and determine whether the lines are crooked or the characters aren't properly formed. You then choose the sections of text you wish to work on by cursoring around the greeked overview. This process is important for filtering stray marks from the periphery of the passage.

The software comes with two font files to hasten the training process. The files, generically named BOOK and COURIER, contain several different 10- and 12-point typefaces, including HP LaserJet Courier, Dutch, and Swiss. Once trained, a font can be edited or expanded.

When you're training a font, the top of the screen displays a single line of scanned text at a time, with a box around the current character. You type the letter that corresponds to the boxed one for the first words in the passage; *CAT Reader* tallies trained and untrained characters at the bottom of the screen.

You then perform interactive OCR to finish the training; although the process is similar to the previous step, *CAT Reader* now prompts you only for the characters it doesn't recognize. Once a font is sufficiently trained, you perform regular OCR, in which the software flags unknown characters and saves the output as an ASCII, *WordStar*, or *WordPerfect* file. The word processor output uses soft returns rather than hard returns at the ends of lines.

Although you don't quite need eagle eyes, nerves of steel, or the hands of a surgeon to use *CAT Reader*, these would certainly help. Nothing about the process is difficult—it's just tedious. First you have to get a clean, relatively straight scan, which isn't too difficult (except with small point sizes) but takes some trial and error.

As for straight scanning, *CAT Reader*'s ability to handle a line skew of up to 10-percent is sufficient for short passages. The 10-percent skew refers to the threshold at which *CAT Reader* will choke and give an error message; before then, it cuts off the tops or bottoms of characters, rendering them unrecognizable.

CAT Reader does a reasonable OCR job—most of the time. Typically, it took me about half an hour to train a font on a passage until *CAT Reader* rendered understandable output. But when I'd try to recognize a new passage in the same font, the results were disappointing.

The software had trouble with italics and boldface, and too often *CAT Reader* couldn't separate groups of characters. Also, the package had the usual problems differentiating between similar characters, such as *c*, *e*, and *o*. Training a font from scratch can take hours; only Courier took the claimed 15 minutes.

In addition, *CAT Reader* just doesn't seem like a finished product; numerous oversights hamper its smooth operation. For instance, in Font Training, the screen redraws every time the box moves to the next character. This slows things down considerably and can be downright annoying. In page-zoning mode—the one place where constant screen redraws would be useful—selection boxes overlay one another instead.

Font editing consists solely of deleting characters; to figure out which characters need to be deleted, you have to painstakingly analyze the output for consistently misrecognized characters. Then, to retrain those characters, you have to run through a process similar to training; the only way to reach a chosen character is to go through a line, one character at a time, with the screen redrawing every time.

While page zoning, the greeking makes it difficult to tell what you've selected; the zoomed window should show you where the cursor is in the text. If you make a mistake in any submenu, such as forgetting to change a parameter before choosing an input file, you have to exit to the main menu and start that procedure over.

If you need to input many short passages from a limited number of sources, the time you'll have to invest in training the fonts and scanning the text is probably worth while. Otherwise, buy yourself a desktop scanner and a high-end OCR package or settle for typing in the few items you need. ■

FACT FILE

CAT Reader
Computer Aided Technology, 7411 Hines Pl., #212, Dallas, TX 75235; (214) 631-6688.
List Price: $295
Requires: 640K RAM, supported hand scanner, CPU with minimum clock speed of 6 MHz, hard disk, graphics adapter, DOS 3.0 or later.
In Short: Easy-to-use but unfinished software that brings passable OCR to hand-scanner users.

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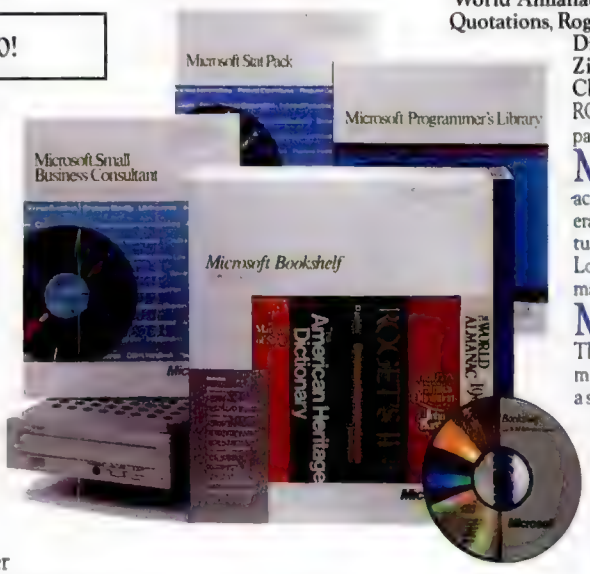

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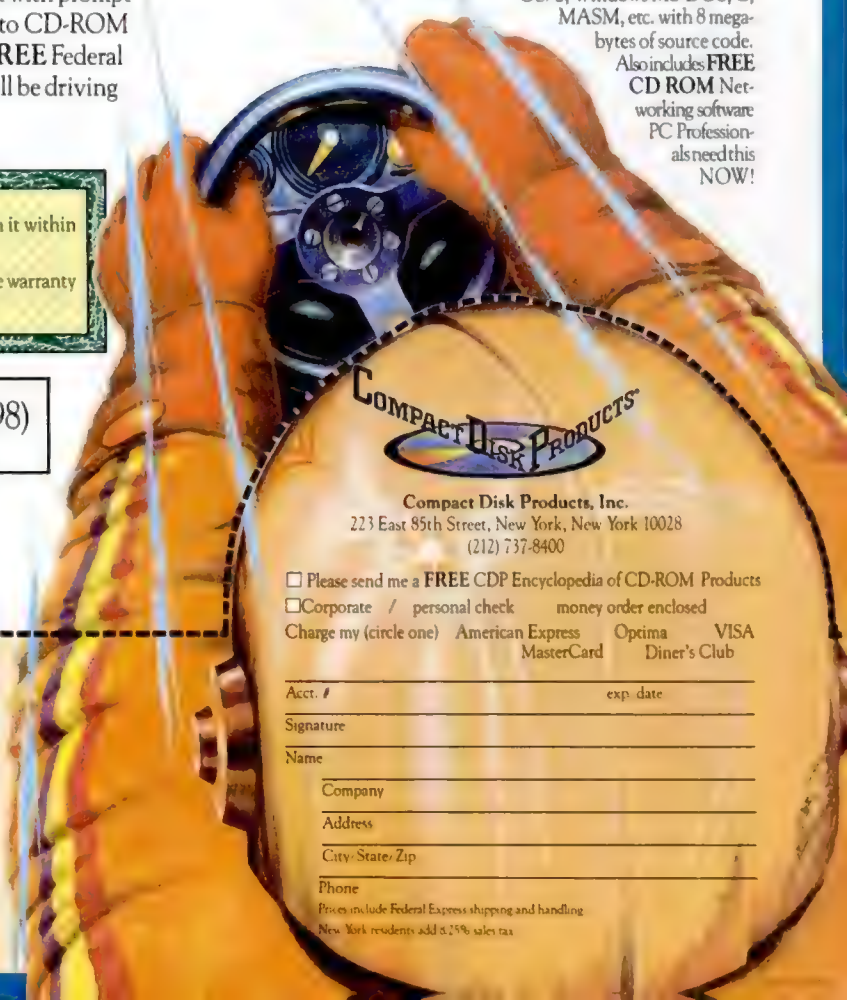

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Instant Recall: Personal Information Management Takes the TSR Route

HANDS ON
by Jonathan Matzkin

Using any personal information manager can make you feel as if you're working at someone else's desk, forcing you to adapt to an unfamiliar style of doing things. That said, whether you'll find Chronologic Corp.'s *Instant Recall*, a $99.95 personal information manager, to be a comfortable, productivity-enhancing work environment depends upon how well its method of imposing structure on the flow of information and tasks dovetails with your own.

As is evident from the moment you tap Ctrl-Alt-I to pop up the opening screen of the memory-resident application, *Instant Recall* was created by people who have definite ideas about how best to approach the management of personal data. The left half of the screen displays your schedule for the day, while the right window presents "reminders" that summarize free-form notes, tasks that are due or overdue, and people whom you need to contact. The right window can also display reminder information for any future date.

If your primary use of a personal information manager will be to track tasks, people, and deadlines, this approach should work well. But if you need to focus more on concepts and interrelationships, *Instant Recall*'s attention to event tracking may be somewhat limiting. According to Chronologic, the next version of the program will offer the choice of having a to-do list or a summary of free-form notes as your opening screen.

Beyond the opening screen, you will find considerable power and flexibility in *Instant Recall*'s individual tools. The main tools are a note taker, a scheduler, a to-do list (called a Task view), and an address book (called a People view).

The note taker is especially robust. When you open a new note, you can set a reminder alarm and associate the note with a person, task, or category. You can create notes up to 65,000 characters long, all the while employing the note taker's many word-processor-like amenities.

The note taker's summary screen allows you to flip through abbreviated versions of your notes and then zoom in on the one you want. You can search your notes for any string of text. An easy-to-use conversion utility imports notes from *Tornado* files.

***Instant Recall*'s note taker has a summary screen that shows the text in each note up to the first carriage return.**

The People view resembles an address book but offers more than the usual *SideKick*-like functionality. For example, you can embed a note behind any entry, which is very useful for tracking the content of successive phone conversations.

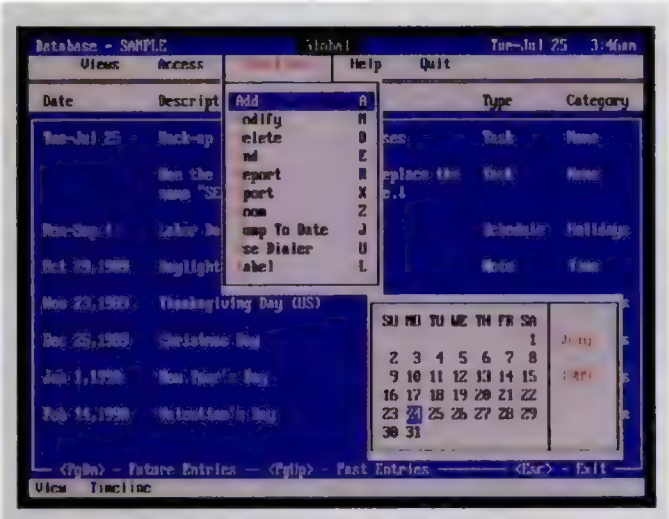
The Task view lets you develop to-do lists. You can specify an alarm time and a priority for each task, and *Instant Recall* tracks which of your tasks are overdue.

Instant Recall's Global view pulls together information from the other views in a single, organized screen. Here you see schedule entries, tasks, people entries with follow-up dates, and notes. The clear, chronological arrangement of this screen lets you easily grasp how your pieces of information are related.

If a personal information manager is to help you without running your life, it should be instantly available without forcing you to leave your current application. That's why memory residence—in only 32K—is a feature of the program that will appeal to you no matter how you work. But *Instant Recall*'s designers exploit memory residence for more than convenience. The resident kernel supports a number of background timing and alarm features, which are well-integrated with the software's scheduling and reminder functions.

When you enter a schedule item, for example, you can also specify a reminder interval. If you schedule a meeting and ask for a reminder 1 hour in advance, *Instant Recall* pops up a note on your screen and sounds an alarm at the appropriate time.

At $99.95, *Instant Recall* delivers many high-end features at a bargain price. You can't learn how to use this application in 15 minutes, as you can Micrologic's *Tornado* or Broderbund's *MemoryMate*, but the program's excellent documentation should smooth the learning process for all but the most inexperienced PC users. ■



***Instant Recall*'s Global view pulls together notes and tasks to provide an integrated view of your data.**

FACT FILE

Instant Recall
Chronologic Corp., 5151 N. Oracle, #210, Tucson, AZ 85704; (602) 293-3100.
List Price: $99.95
Requires: 512K RAM (resident size, 32K), 720K free disk space, DOS 3.0 or later.
In Short: A powerful, inexpensive, and relatively easy-to-learn personal information manager that features a note taker, a scheduler, a to-do list, and an address book. Memory residence makes the program immediately useful.

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CIRCLE 163 ON READER SERVICE CARD

What-If Analyst: First 1-2-3, Release 3, Add-in Reduces Educated Guessing

HANDS ON
by Rock Miller

Spreadsheets are a big help in trial-and-error work, but homing in on a specific figure can still be a time-consuming task, especially if your formulas use complex functions or depend on a long chain of cell references.

What-If Analyst can help save you some steps in this process. This *Lotus 1-2-3* add-in from Frontline Systems lets you start with a goal value for a formula cell and calculate the value another cell needs to have if you're to arrive at that goal.

One of the first available LEAF add-ins for *1-2-3*, Release 3, the program is also available in C versions for *1-2-3*, Release 2, and for *Symphony*. All versions are included in the same package for $49.95, a thoughtful touch in these days of upgrade anxiety.

What-If Analyst does its job with a minimum of fuss. You simply specify the what-if cell (the cell whose value you want to discover), the result cell that contains the formula, and the goal for the result cell. *What-If Analyst*'s goal-seeking algorithm calculates the appropriate value for the what-if cell and inserts it into your spreadsheet.

A few options help you handle more-complex formulas. You can choose the upper and lower bounds to limit the search if the goal can be achieved by more than one what-if value. You can also adjust the precision and the maximum number of iterations in the algorithm, to conserve time and processor power. If you have a math coprocessor installed, the program will use it automatically.

What-If Analyst's emphasis on the basics leaves it a bit on the minimalist side in spots. The program doesn't prompt you before inserting the results into your spreadsheet, and it doesn't keep track of them after that point. If you decide to try another goal, your only recourse is to abandon the worksheet and recall it from disk.

Another significant limitation is that the what-if cell must be a numeric value; it can't be another formula. This forecloses some useful strategies. For example, you might want to trim your supplies budget to meet your quarterly target. But since the total supplies budget is likely to be calculated from other cells, you'd have to convert the subtotals to numeric values in order to analyze them.

What-If Analyst is best seen as a tool rather than as a packaged solution, especially in combination with Release 3's macro facilities (the Release 2 version doesn't support macros). But as a basic module that does a simple thing well, it is worth its bargain price. ■

List Price: *What-If Analyst*, $49.95. **Requires:** 36K to 45K RAM; *Lotus 1-2-3*, Release 2.01, 2.2, or 3.0, or *Symphony* 1.1, 1.2, or 2.0; DOS version required depends on spreadsheet program. Frontline Systems Inc., 140 University Ave., #100, Palo Alto, CA 94301; (800) 451-0303, ext. 55.

CIRCLE 431 ON READER SERVICE CARD

PC Tools 5.5 Features dBASE And 1-2-3 Viewers, Network Support

HANDS ON
by Edward Mendelson

PC Tools Deluxe, Version 5.1, which appeared last winter, did almost everything that you expect from a desktop accessory and DOS utility package. Version 5.5, released this summer, does everything else.

For the new version, which sells for $129, Central Point Software added *Lotus 1-2-3* and *dBASE* file viewers and a scientific calculator to 5.1's programs, most of which have been improved in performance, ease of use, or both.

PC Tools' disk utilities include a backup program, disk cache, defragmenter, undeleter, encryption program, and multipurpose DOS shell. Its desktop set is weighed down with notepads, *dBASE*-compatible databases, algebraic and financial calculators, a spelling checker, an outliner, a calendar, and a rudimentary communications module.

The DOS shell has matured to the point where it can serve as a visually crowded but highly functional environment from which to launch applications and manage files. The shell can be run from a network server and recognizes network drives, but the earliest copies of 5.5 had trouble handling the somewhat similar phantom drive letters created by the SUBST command.

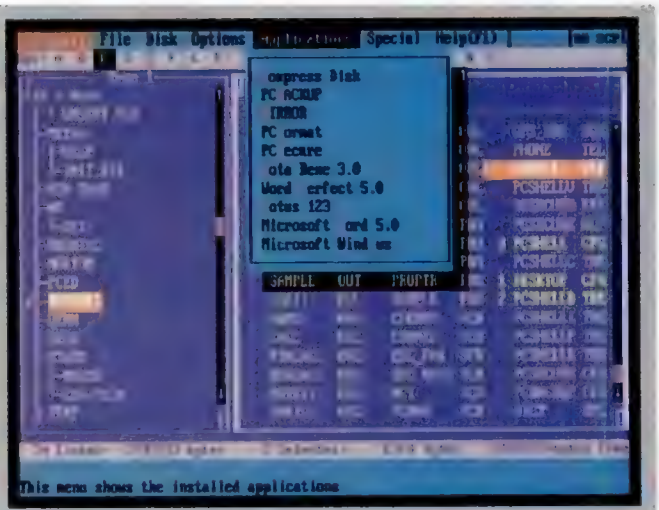
When you install *PC Tools*, it scans all of the partitions on your disk for copies of common applications and automatically installs them in the menu of the DOS shell—along with *PC Tools*' own disk utilities. If you highlight a .WK1 file in one of *PC Tools*' directory screens and click on it twice with a mouse, the shell launches *1-2-3* and loads the worksheet.

PC Tools' backup program—probably the most popular program in the package but also the most problematic part of Version 5.1—has been polished up with streamlined menus, function-key shortcuts, and improved performance. It ranks as one of the best backup programs available at any price. The file-encryption program now optionally overwrites the original data in the encrypted file to the point where nothing can recover it, and it fully conforms to government security standards.

Owners of Version 5.1 can upgrade to 5.5 for $20 or can download the new version from Central Point's BBS at (503) 690-6650, perhaps using *PC Tools*' communications program to make the call. How does Central Point prevent software pirates from hoisting the Jolly Roger and phoning in for a free copy? Very ingeniously—by storing the new version in encrypted files that can be unscrambled only by *PC Tools*' own file-encryption program. *PC Tools* is one of the few programs that obtains its own successor. ■

List Price: *PC Tools Deluxe*, Version 5.5, $129. **Requires:** 512K RAM (hard disk and 320K EMS recommended), DOS 3.0 or later. Central Point Software, 15220 NW Greenbriar Pkwy., #200, Beaverton, OR 97006; (503) 690-8090.

CIRCLE 448 ON READER SERVICE CARD



PC-Tools, Version 5.5, automatically installs common applications in its DOS shell.

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by
Alan Cohen

New&Improved

News of Announced Products and Upgrades

Options Enhance Compaq SLT/286 Versatility

NEW

As long as there have been laptop computers, there has invariably been some poor overworked soul plugging away at 20,000 feet or at the neighborhood Holiday Inn. But that was just for starters. Now, thanks to **Compaq**'s latest offering, owners of the company's SLT/286 laptop can work on memos or spreadsheets as they sit in their car and wait for the light to turn green.

The $69 Automobile Adapter for the Compaq SLT/286 plugs into any vehicle's cigarette lighter socket, which serves as an external power source for the computer. So now, instead of wasting idle car time turning around and telling the kids to be quiet, you can simply ignore them and work on next Tuesday's big presentation.

Another new SLT/286 option from Compaq is the $149 External Battery Charger. This $149 unit connects to the laptop's AC adapter and can charge an empty battery pack in 1.5 hours. The charger holds two battery packs, but charges one at a time.

Compaq's External Battery Charger for the SLT/286 laptop can recharge an empty battery pack in 1.5 hours.

List Price: Automobile Adapter, $69; External Battery Charger, $149. **Requires:** Compaq SLT/286 laptop computer. Compaq Computer Corp., 20555 SH 249, Houston, TX 77070; (713) 370-0670.

CIRCLE 438 ON READER SERVICE CARD

HOT PROSPECT

PacificPage Gives Your LaserJet Plug-In PostScript Compatibility

LaserJet Series II owners who'd like full PostScript compatibility without having to deal with add-in boards or floppy disks can now have their cake and eat it too, with **Pacific Data Products'** latest release, PacificPage.

PacificPage is a plug-in cartridge that provides LaserJet users with complete PostScript compatibility, and 35 Apple LaserWriter NT–equivalent font families in unlimited point sizes. The cartridge uses Phoenix Technologies' PhoenixPage PostScript interpreter, and has PostScript, Version 47, capabilities, including reversed text, scaled fonts, and such high-resolution graphics as arcs, circles, screens, patterns, and half-tone images.

PacificPage is compatible with all software packages that support PostScript output.

List Price: PacificPage, $695. **Requires:** HP LaserJet Series II or compatible printer with 2MB of memory. Pacific Data Products, 6404 Nancy Ridge Dr., San Diego, CA 92121; (619) 552-0880.

CIRCLE 437 ON READER SERVICE CARD

The LaserJet runs off the ROM code inside the PacificPage cartridge.

Say Goodbye to "The Thermal Look" With the Omnifax PPI

NEW

Adding to the ever-growing array of PC-based fax products is **Telautograph Corp.**'s Omnifax PPI, a plain-paper interface module that receives facsimile transmissions and prints them out on an HP LaserJet Series II or compatible printer.

The $1,395 PPI is not a plug-in board, but a desktop peripheral that connects directly to a standard phone line and the laser printer's parallel port. No fax machine is needed (although one can be used in conjunction with the PPI). The unit is shipped with 1MB of internal RAM (which allows for the storing of up to 60 pages of incoming faxes) and requires that the laser printer used also be equipped with at least 1MB of RAM. According to the company, when the PPI is used with the LaserJet, the average print speed is two pages per minute.

PC users who already have a fax machine connected to their system can use the PPI to receive and print facsimiles and the standard fax unit to send outgoing transmissions. Only one phone line is needed to both receive and transmit faxes.

The Omnifax PPI receives fax transmissions and sends them to a laser printer for output on plain paper.

Telautograph's PPI peripheral receives CCITT Group III faxes at 9,600 bits per second in either standard or fine print modes.

List Price: Omnifax PPI, $1,395. **Requires:** HP LaserJet Series II or compatible printer with 1MB RAM. Telautograph Corp., 8700 Bellanca Ave., Los Angeles, CA 90045; (213) 641-3690.

CIRCLE 439 ON READER SERVICE CARD

Copyrighted materia

New & Improved

$49 PC-Browse Displays, Searches, Links Files

NEW

You're working on a spreadsheet and you'd like to scan a text file for some information. But you'd rather not have to save your worksheet and exit the program to do it. As the man on the traveler's check commercials says, "What *will* you do?"

You can get a copy of *PC-Browse*, a $49 shareware program from **Quicksoft.** *PC-Browse* is a file-scan and hypertext information tool that allows you to view files, search them for specific information, and link them together.

In its RAM-resident mode, the program lets you call up a *PC-Write* or ASCII text file over any application. You can also bring up a DOS directory and display any file with a single keystroke. Once viewed, *PC-Browse* can print information from the file or paste data into the current application.

Using the program's search capabilities, you can locate text strings and "lost" files or text. A feature called Lookup finds information in files that have sorted records quickly—according to the company, it takes less than 1.1 seconds to search a 2MB file.

To link words or phrases within a file, between two files, or among many files, you mark them with a specific keyword. You jump from a keyword reference to the corresponding keyword target within the same or another file by pressing the Enter key.

Furthermore, *PC-Browse* enables users to customize hotkeys to optimize use with other RAM-resident programs and to reconfigure the buffer size so that it uses only the bare minimum of RAM.

List Price: *PC-Browse*, full registration, $49.
Requires: 60K RAM, DOS 2.0 or later.
Quicksoft Inc., 219 First Ave. N., #224, Seattle, WA 98109; (800) 888-8088.

CIRCLE 443 ON READER SERVICE CARD

Rechargeable bATPac Replaces Your Computer's Battery

NEW

A failing backup battery can do wonders for your computer's memory. Suddenly, the internal clock loses track of the time and date, important setup information such as disk drive parameters may mysteriously disappear, and worse, unpleasant hardware and software errors may plague you like Charlton Heston plagued Yul Brynner in The Ten Commandments.

That's where **Rupp Corp.** comes in. Rupp manufactures bATPac, a $40 rechargeable backup battery for the IBM PC AT and

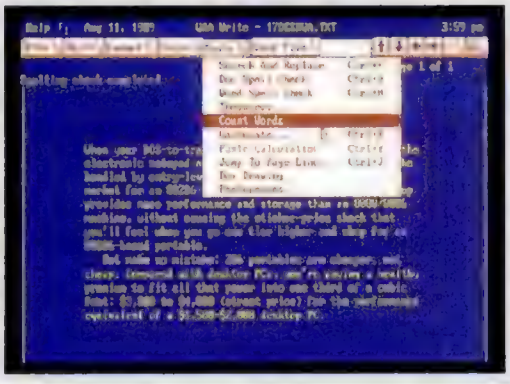
CONTINUES ON PAGE 56

bATPac replaces your computer's short-lived backup battery with a rechargeable one that will last 10 years, according to the company.

IMPROVED

by Alan Cohen

DeskMate Q&A Write—Symantec Corp. has introduced a version of its *Q&A Write* word processing software for use with Tandy's *DeskMate* graphical user interface. It features pull-down menus, pop-up dialog boxes, mouse support, page preview, and enhanced graphics capabilities. Furthermore, the package provides users with the capability of pasting in text and graphics from other *DeskMate* applications. *DeskMate Q&A Write* is based on Symantec's *Q&A Write*, Version 1.01. An integrated Card File that can hold up to 1,000 forms is also included, and *Lotus 1-2-3* and *Symphony* users can import their spreadsheets into any *Q&A* document. *DeskMate Q&A Write* retails for $199. Symantec Corp., Cupertino, Calif.; (408) 253-9600.



The latest release of *Q&A* operates within Tandy's *DeskMate* graphical interface, a *Windows*-like environment featuring pull-down windows and pop-up dialog boxes.

***Freelance Plus*, Version 3.01**—*Freelance Plus* 3.01 is a reduced-memory version of Lotus Development Corp.'s graphics application software. The new release occupies 438K of memory after DOS is loaded, compared with the 508K chunk required by the more-RAM-hungry *Freelance Plus* 3.0. In order to reduce memory requirements in Version 3.01, Lotus shrank the size of the product's code, reorganized the memory-management scheme, and changed the overlay structure to make more-efficient use of available memory. Users who do not need to create complex charts and drawings can run the program in only 415K of RAM by using a DOS command-line switch that decreases the amount of memory allocated for charts and drawings. *Freelance Plus* 3.01 retails for $495. All registered owners of *Freelance Plus* 3.0 and owners of *Freelance Plus* 2.0 or 2.01 who purchased that package after September 6, 1988, may upgrade to the new version for $20. Otherwise, there is a $100 charge to upgrade to *Freelance Plus* 3.01 from *Freelance Plus* 2.0 or 2.01, and a $150 charge to upgrade from 1.0. Lotus Development Corp., Cambridge, Mass., (617) 577-8500, (800) TRADE-UP for upgrade details.

***Clipper*, Version 5.0**—The newest version of Nantucket Corp.'s PC application development package allows programmers to circumvent the 640K barrier and develop large applications without building overlays. *Clipper*'s new linker automatically handles the allocation of the program in memory, thus removing that responsibility from the programmer. According to the company, an exclusive version of .RTLinker, a subroutine that consolidates multiple files of compiled code into a single executable file, gives *Clipper* 5.0 a sharply reduced link time, speeding up the development cycle.

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Copyrighted materia

BORLAND'S TURBO C PROFESSIONAL 2.0

CORPORATE TOP RATED PC WEEK 1989 SATISFACTION POLL

PC WEEK POLL: C COMPILERS

	Overall Weighted Score	Overall Reliability	Complete of Command Descript.	Overall Perform.	Complete & Organiz. Document.	Document Clarity	Compiling Process Efficiency	Product Support Quality	Value Relative To Cost	Product Support Access.
Turbo C 2.0 (Borland International)	81	87	79	84	77	78	86	72	70	93
C Optimizing Compiler 5.1 (Microsoft Corp.)	76	83	80	81	78	74	76	68	67	70
C++ 1.07 (Zortech Inc.)	66	68	64	71	63	63	69	60	58	76

"Microsoft was No. 1, but they have been unseated by Borland." PC Week, *May 8, 1989*

PC WEEK POLL: SOFTWARE DEBUGGERS

	Overall Weighted Score	Overall Reliability	Effective. Programmer Interface	Document. Clarity	Complete. Command Descript.	Complete. & Organize. Document	Overall Perform.	Integration Within Programming Environment	C Compiler Compatibility	Product Support Quality	Product Support Access	Value Relative To Cost
Turbo Debugger 1.0 (Borland International)	84	89	90	81	81	81	89	88	81	73	72	93
Codeview 2.2 (Microsoft Corp.)	73	80	71	72	74	74	74	74	78	67	64	72

"Borland's Debugger outshines Microsoft's Codeview." PC Week, *May 15, 1989*

It's two winners in one.

Turbo C,* the core of Turbo C Professional, was the outright winner in *PC Week*'s Poll of Corporate Satisfaction on C compilers. Overall, Borland won with 81. Microsoft* placed second.

Turbo Debugger,* also included in Turbo C Professional, was the outright winner in EVERY category in *PC Week*'s Poll Of Corporate Satisfaction on Debuggers. And, once again, we topped the score with 84, overall. Microsoft came in second-best, 11 points behind.

Get Borland's Turbo C Professional and get the best of both worlds: our top-rated C compiler and our top-rated Debugger.

Call **(800) 345-2888*** and we'll send you both *PC Week* polls and technical specifications on Turbo C and Turbo Debugger.

Turbo C Professional includes both Turbo C 2.0 and Turbo Assembler® & Debugger.

BORLAND

Code: MC33

*From Canada, Call (408) 848-4391. Reprinted from PC Week, May 8, 1989; PC Week, May 15, 1989. Copyright ©1989 Ziff Communications Company. Turbo C, Turbo Debugger, and Turbo Assembler are registered trademarks of Borland International. Copyright ©1989 Borland International, Inc. All rights reserved. BI 1328

CIRCLE 377 ON READER SERVICE CARD

Best Cache For Little Cash

Even if your computer has a memory cache, disk caching can double or triple your system performance for only $79.95. Read what the editors of PC Magazine say about Multisoft's products in the February 14, 1989 issue.

PC MAGAZINE EDITOR'S CHOICE

• **Super PC-Kwik**

Speed is the only reason to use a disk cache, but speed isn't the only criterion to use in choosing one. The best cache program is the one that speeds up disk activity while occupying the least DOS memory and adapting to the special requirements of your work and your computer.

Super PC-Kwik *is the fastest cache program available, and it's also the one with the most useful and sensible options. You can squeeze it down to as little as 9K of RAM and still maintain a half-megabyte cache in expanded memory. You can also benefit from its speed and intelligence if you keep the cache in conventional or extended memory.*

When you combine it with the RAMdisk, print spooler, and other programs in Multisoft's PC-Kwik Power Pak, Super PC-Kwik *makes better use of your memory than any other cache you can buy.*

Order Super PC-Kwik today and see what the industry's best disk cache can do for you, or get the most for your money with our 5-in-1 Power Pak.

Super PC-Kwik $79.95

Power Pak $129.95

30-day money-back guarantee

Multisoft Corporation
15100 SW Koll Pkwy, Suite L
Beaverton, OR 97006
503-644-5644

800-283-6858

CIRCLE 170 ON READER SERVICE CARD

New & Improved

bATPac

CONTINUED FROM PAGE 54

compatibles. bATPac, a true rechargeable sealed battery that continuously charges while the computer system is on, backs up the clock and setup information. It operates for up to 12 months on a single charge and has a life expectancy of over 10 years, according to the company.

The battery, which is sealed in a high-impact polystyrene case that measures approximately 2.4- by 2.4- by 1-inch, is installed by connecting it to your computer's standard disk drive power connector and then plugging the accompanying bATPac cable into the AT's external battery connector. A spare disk drive power connector is supplied to replace the one used by bATPac. The company also provides velcro to stick bATPac to the AT's power supply.

List Price: bATPac, $39.95. **Requires:** IBM PC AT or compatible. Rupp Corp., 835 Madison Ave., New York, NY 10021; (212) 517-7775.

CIRCLE 440 ON READER SERVICE CARD

IMPROVED

CONTINUED FROM PAGE 54

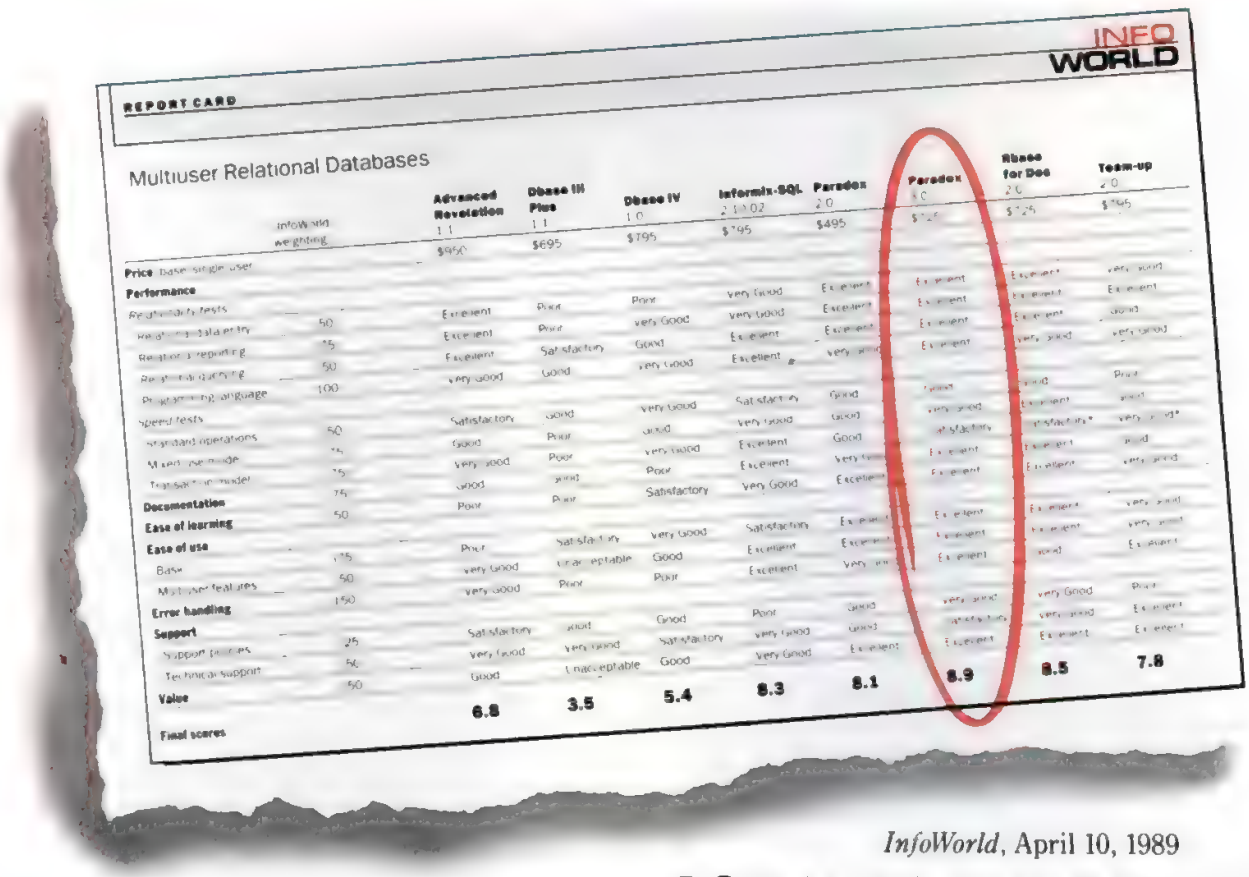
The package also offers user-defined commands (UDC), compiler directives that improve programmer productivity, and multidimensional arrays. *Clipper* 5.0 retails for $795, and registered owners of any previous version can upgrade for $195. Owners who made their purchase between June 1 and September 15, 1989, will be eligible for a free upgrade. Nantucket Corp., Los Angeles, Calif.; (213) 390-7923.

***PerFORM*, Version 2.0**—Version 2.0 includes additional form-creation capabilities, including full support of PostScript fonts, an on-line help feature, an undo command, line art, bar codes, picas and points, and text import. New form-fill features include lookup of *dBASE* files, *dBASE* import and export of files, and thorough table lookups. Delrina also claims to have improved *PerFORM*'s printing speed. The new package retails for $294.95. Owners of *PerFORM* 1.0 packages purchased after April 1, 1989, are entitled to a free upgrade; all other users can receive the upgrade to the enhanced version for $54.95. To accommodate form filling on multiple PCs, the form-fill portion of the package, *PerFORM 2.0 Filler*, is available separately as well. It carries a retail price of $129.95. *PerFORM 2.0 Filler LAN Pack*, which consists of local area network software and a license to run *PerFORM 2.0 Filler* on up to five PCs, is also available for $599.95. Delrina Technology Inc., Toronto, Ontario, Canada; (416) 423-0456.

***PerFORM* 2.0 now features rulers in inches and interchangeable screen views.**

SoftCraft's *Font Solution Pack*, Version 2—Version 2 of SoftCraft's *Font Solution Pack* features an integrated menu-based user interface, support for *Microsoft Word* 5.0, and, through the new Spinfont option, the capability to automatically create curved, rotated, and reversed text directly from any Bitstream Scalable Typeface. Version 2 retails for $495; registered owners of *Font Solution Pack* 1.0 can receive the upgrade free of charge. SoftCraft Inc., Madison, Wis.; (800) 351-0500, (608) 257-3300 in Wis.

Connection CoProcessor for MCA—Intel's Micro Channel version of its Connection CoProcessor features several software and menu enhancements that are similarly available in a new version of the classic bus model. These enhancements include a revised phonebook alphabetization scheme that sorts by first name entered; accommodation for credit card and international dialing; a serial dialing retry process; the ability to revise cover letters without redoing an entire message; and the option to transmit cover pages only. The Connection CoProcessor for Micro Channel computers retails for $995. Intel Personal Computer Enhancement Operation, Hillsboro, Oreg.; (800) 538-3373.



INFO WORLD

REPORT CARD

Multiuser Relational Databases

	InfoWorld weighting	Advanced Revelation 1.1	Dbase III Plus 1.1	Dbase IV 1.0	Informix-SQL 2.10.02	Paradox 2.0	Paradox 3.0	Rbase for Dos 2.0	Team-up 2.0
Price (base single user)	—	$950	$695	$795	$795	$495	$725	$725	$795
Performance									
Report/query tests	—	Excellent	Poor	Poor	Very Good	Excellent	Excellent	Excellent	Very good
Relational integrity	50	Excellent	Poor	Very Good	Very good	Excellent	Excellent	Excellent	Excellent
Relational reporting	75	Excellent	Satisfactory	Good	Excellent	Excellent	Excellent	Excellent	Good
Report/query writing	50	Very Good	Good	Very Good	Excellent	Very good	Excellent	Very good	Very good
Programming language	100	—	—	—	—	—	—	—	—
Speed tests	—	—	—	—	—	—	—	—	—
Standard operations	50	Satisfactory	Good	Very Good	Satisfactory	Good	Excellent	Good	Poor
Multiuser mode	75	Good	Poor	Good	Very Good	Good	Very good	Excellent	Excellent
Transaction model	75	Very Good	Poor	Very Good	Excellent	Good	Excellent	Excellent	Excellent
Documentation	50	Good	Poor	Poor	Excellent	Excellent	Excellent	Satisfactory*	Very good
Ease of learning	—	Poor	Satisfactory	Satisfactory	Very Good	Excellent	Excellent	Excellent	Good
Ease of use	—	Very Good	Unacceptable	Very Good	Satisfactory	Excellent	Excellent	Excellent	Very good
Base	175	Very Good	Poor	Good	Excellent	Excellent	Excellent	Excellent	Excellent
Multiuser features	50	Very Good	—	Poor	Excellent	Very good	Excellent	Excellent	Excellent
Error handling	150	—	—	—	—	—	—	—	—
Support	—	Satisfactory	Good	Good	Poor	Good	Very good	Very Good	Poor
Support policies	25	Very Good	Very Good	Satisfactory	Very good	Good	Satisfactory	Excellent	Excellent
Technical support	50	Good	Unacceptable	Good	Very Good	Excellent	Excellent	Excellent	Excellent
Value	50	6.8	3.5	5.4	8.3	8.1	8.9	8.5	7.8
Final scores									

InfoWorld, April 10, 1989

BORLAND'S PARADOX 3.0

The bottom line is 8.9

InfoWorld magazine tested and compared multiuser databases. With a bottom-line score of 8.9, Borland's new Paradox® 3.0 beat the well-knowns and unknowns hands down.

So read what *InfoWorld*'s Report Card says about relational databases—and if you'd like to try Paradox 3.0 first, there's one more thing you can do.

Call (800) 345-2888, ext. 100. We'll send you a free Trial Version of Paradox 3.0 and a reprint of *InfoWorld's* multiuser database review.*

BORLAND

*Offer expires September 15, 1989

CIRCLE 147 ON READER SERVICE CARD

Code MP85

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IN THE BATTLE FOR 286 LAPTOP POWER, SHARP IS THE CLEAR WINNER.

INTRODUCING THE SHARP PC-5541.

Now, Sharp technology elevates the 286 laptop to a new dimension of power, speed and display resolution, with the PC-5541.

HIGH RESOLUTION VGA PAGE-WHITE DISPLAY.

The PC-5541 features VGA resolution on a page-white, backlit, double-super-twist liquid crystal display. Developed and produced by Sharp, it boasts an industry leading 640 x 480 resolution with 16 shades of gray. All of which help to make the PC-5541 the unsurpassed 286 laptop.

FAST 40 MB HARD DRIVE.

The Sharp PC-5541 beats the competition with a fast (25ms) 40 MB hard drive. Add that to its 12 MHz clock speed and internal RAM expandable to 3.6 megabytes, and you've got a 286 laptop with an unbeatable combination of power and speed.

EXTENDED BATTERY LIFE.

The PC-5541 comes standard with an internal 2.0 hour battery. Or for use on those long trips, get up to an impressive 5.5 hours of operation with an optional add-on battery "slice". Or it can be plugged into any AC outlet.

The PC-5541 also boasts a full-featured, step-sculptured keyboard, which greatly enhances the machine's ease of use and user comfort.

For unsurpassed laptop power, speed, and display quality, there's only one choice. Sharp.

For more details about the winning laptop, just call 1-800-BE-SHARP.

SHARP
FROM SHARP MINDS COME SHARP PRODUCTS™

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CIRCLE 110 ON READER SERVICE CARD

New & Improved

Trading Places Swaps dBASE with Other Applications, TSRs

NEW

Ashton-Tate's Tate Publishing Division has released a new software product that now makes it possible for *dBASE* users to transparently swap *dBASE III Plus* and *dBASE IV* in and out of memory.

The $100 program, called *Trading Places*, can trade up to 32 TSR programs between disk and memory, thereby eliminating any need to exit an application to uninstall and reload TSRs. A module called Swap loads a TSR into memory, where it resides until another one is called to take its place. In all, 16 TSRs can be stored. A second module, known as Overlay, uses TSRs with large applications. In this case, a TSR is retrieved from memory, overlayed on the present application, and stored when the task is completed. **List Price:** *Trading Places*, $99.95. **Requires:** 256K RAM, DOS 2.1 or later. Ashton-Tate, 20101 Hamilton Ave., Torrance, CA 90502; (213) 329-8000.

CIRCLE 442 ON READER SERVICE CARD

HiJaak PS Sends PostScript Faxes From Your Fax Board

NEW

Normally, sending a presentation-quality document from a fax board is like spending hours combing your hair only to walk out into the middle of a tornado. All that effort goes for nothing. *HiJaak PS*, from **Inset Systems,** combines LaserGo's *GoScript* and Inset's own *HiJaak* 1.1C to produce faxed documents that look as if they have just come off a PostScript printer.

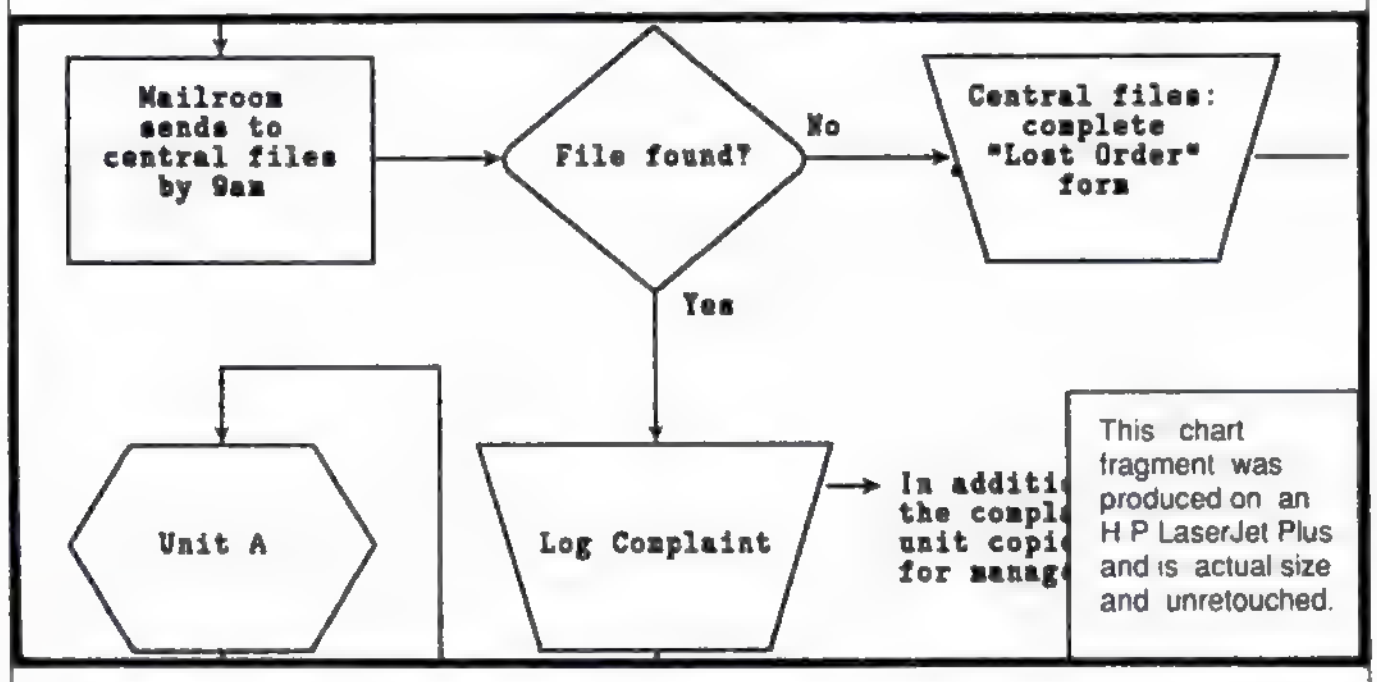
With the $349 *HiJaak PS* you create a document using any of over one hundred applications, including *WordPerfect, Microsoft Word, PageMaker*, and *Ventura Publisher*. *HiJaak* then creates an .EPS file with the text and graphics that normally would have been printed on a PostScript printer. The program converts the file to one of nine fax file formats (including JT-Fax, Complete Fax, and the Intel Connection CoProcessor).
List Price: *HiJaak PS*, $349. **Requires:** 640K RAM, hard disk, one of the nine supported fax cards, DOS 3.0 or later. Inset Systems Inc., 71 Commerce Dr., Brookfield CT 06804; (203) 775-5866.

CIRCLE 441 ON READER SERVICE CARD

EasyFlow

See us at T 1212
COMDEX/Fall '89
November 13–17, 1989
Tropicana Hotel
Las Vegas, Nevada

An on-screen chart processor that knows about charts and diagrams, not just another "screen-draw" program that makes you do most of the work. **EasyFlow** is a powerful full-screen graphics program dedicated to data-flow diagrams, flow charts and organization charts. With it you can quickly compose diagrams. More important, you can easily modify them so they are always up to date.



Automatic. Fully automatic text centering within shapes. Fully automatic line routing & rerouting. Fully automatic placement of text along lines.

Fast. Written in assembly language for speed.

Large. Diagram size limited only by available memory. Supports LIM expanded memory. Diagram too large for your printer? EasyFlow automatically breaks the diagram up & prints it in page size pieces.

Standard. All standard data flow and flowcharting shapes included. Other shape libraries are available.

User friendly. Don't take our word for it. PC Magazine says *"EASYFLOW lives up to its name. It's hard to imagine any easier and more flexible way to produce basic and even complex flowcharts"*.

Mouse. Optional but fully supported.

It works. Over 50,000 copies sold. Two of the "big eight" accounting firms have world wide site licenses for the use of EasyFlow.

It prints. On most popular printers including IBM, Epson, Toshiba, HP LaserJets, HP Desk Jet XEROX 4045, postscript printers and many others.

It plots. On HP7440, 7475, 7550 and 7585B plotters.

Documented: 130 page manual plus over 150 screens of context sensitive help.

Rush delivery: Order by noon today (eastern time) and you'll have it tomorrow. Rush delivery charge is $10.50 (instead of $2.00) and is available only to continental USA and Canada.

EasyFlow works on IBM PC's, IBM PS/2 and compatibles. Requires 512K memory, hard disk and an IBM CGA/EGA/VGA or Hercules monochrome compatible adapter card.

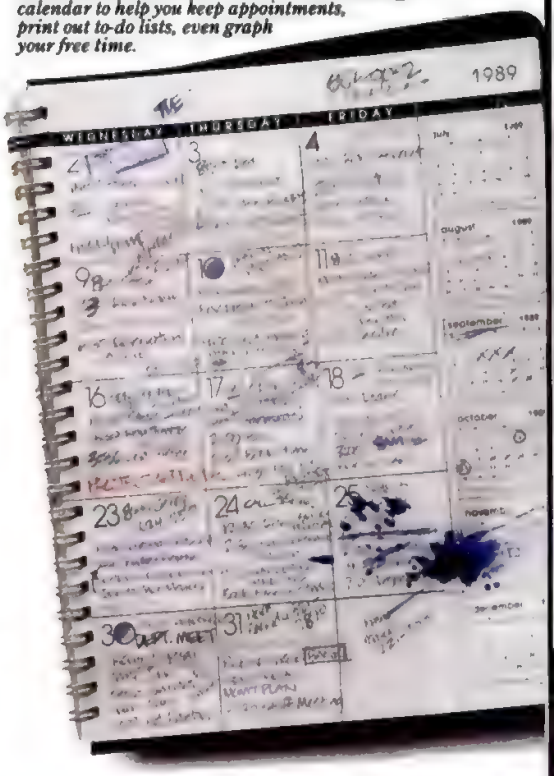
Order direct for only **$149.95** + $2.00 S&H (USA/Canada), $10.00 (foreign).
Payment by M.O., check, VISA MasterCard or Company PO.

Haven Tree Software Limited
PO Box 1093-P
Thousand Island Park, NY 13692

Order Desk: 1-800-267-0668
Information: (613) 544-6035 ext. 49
Telefax(G3): (613) 544-9632

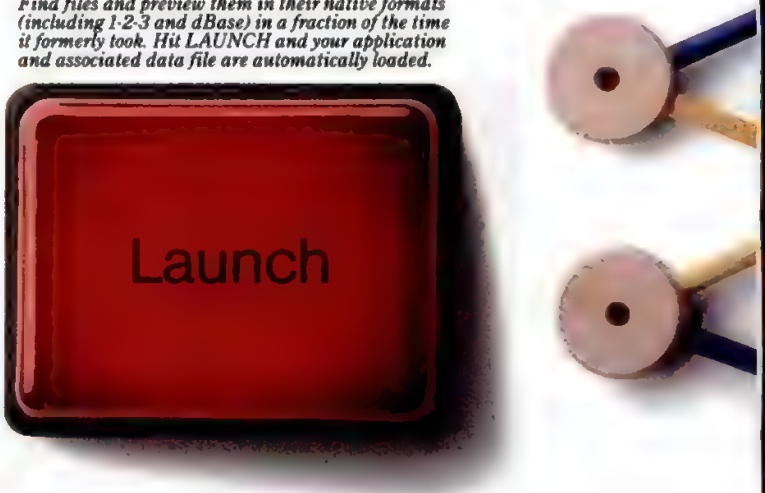
CIRCLE 201 ON READER SERVICE CARD

Many utilities thrive only on misfortune. PC Tools provides first-rate accident insurance plus much more.



Our desktop manager is one of our most noteworthy features. It has a word processor, database, autodialer, telecommunications and much more. Including a calendar to help you keep appointments, print out to-do lists, even graph your free time.

Find files and preview them in their native formats (including 1-2-3 and dBase) in a fraction of the time it formerly took. Hit LAUNCH and your application and associated data file are automatically loaded.



Our clipboard lets you cut information from your spreadsheet and paste it into your word processor (or any other application) without re-entering data or text.

A new visio

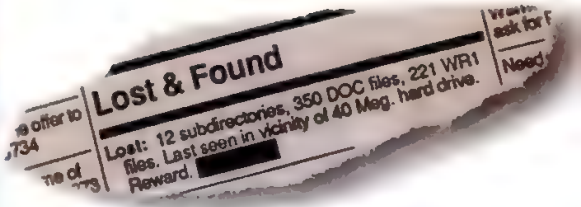
Accidents happen.

And when they do, nobody makes it easier to recover a deleted file or restore a hard disk than PC Tools Deluxe. But Central Point Software believes a utility product should do more than just protect you from misfortune. Do more for you than simply back up your hard disk, recover an inadvertently deleted file, or copy files from a DOS shell.

Central Point's vision is that a utility product should enhance your productivity every moment you're at your keyboard. It should do things like simplify the way you find, preview and load a 1-2-3 spreadsheet. Or, make it easy to combine the contents of one document into another. Even just allowing you to look up a dBASE record while you're in the middle of another application. Everyday tasks. Tasks that, without PC Tools Deluxe, are difficult to do and take way too much time.

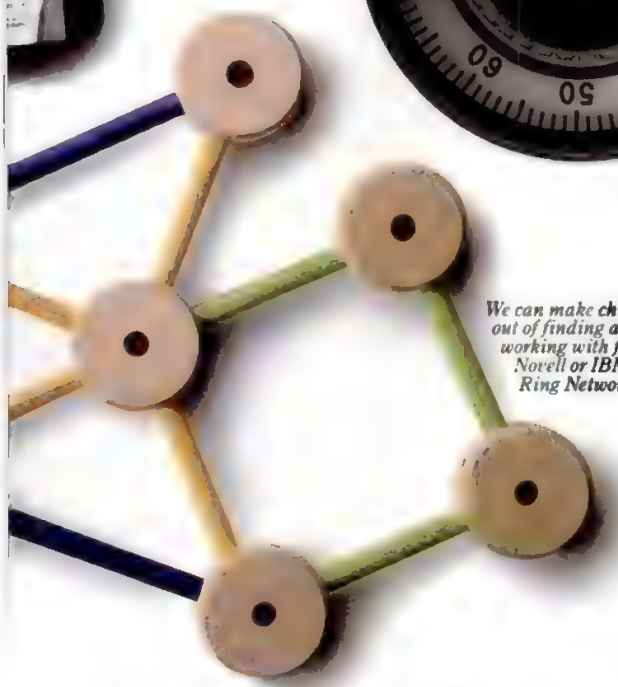
But it's not just what PC Tools Deluxe does that makes it different. Its windowed environment makes doing these things, as well as all of its other functions, simple. The environment's movable, resizable win-

Our PC CACHE can accelerate disk intensive applications dramatically. Hold onto your mouse pads.



Inadvertently losing a file is ***easy to do.*** *Our UNDELETE makes it just as* ***easy to undo.*** *(Recovers entire subdirectories* ***too.****)*

Encrypt financial info, employee data, contracts and other sensitive information in a format nobody can crack. Except you.



We can make ***child's play*** *out of finding and working with files on Novell or IBM Token Ring Networks.*

In the event your disk goes up in smoke, ***PC BACKUP*** *makes sure you won't get burned. It's breathtakingly fast, reliable and extremely easy to use.*

n of utilities.

dows, full mouse support, pull-down menus and context sensitive help make learning and using the product a breeze. And PC Tools Deluxe conforms to IBM's Systems Application Architecture (or SAA) standards so its look and feel will be quite similar to all the other applications you'll see in the 90s.

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CIRCLE 738 ON READER SERVICE CARD

by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Tandy Brings Lotus And Symantec into the DeskMate Fold

Tandy stepped up its slow-and-steady growth plan this summer, when it added two name-brand programs to the *DeskMate* family. The Fort Worth company's long been pushing *DeskMate* as an easier alternative to OS/2 and *Microsoft Windows* multitasking for several years, but it hasn't succeeded in gaining too many converts among major software publishers.

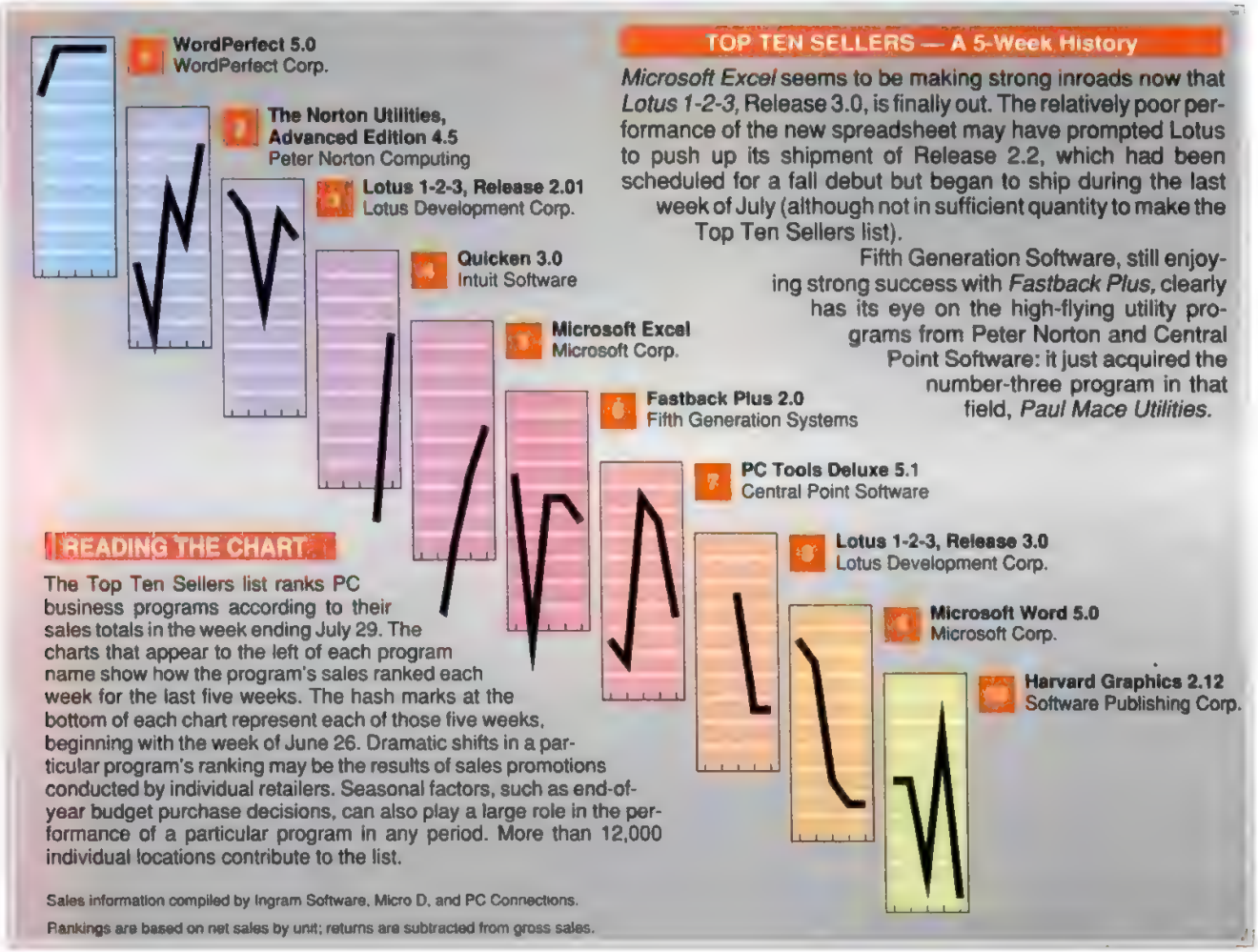
In August, Symantec and Lotus both got religion. It's a major achievement for Tandy, since top software houses are faced with a bewildering choice of tempting new directions for their DOS products (OSF Unix, AT&T Unix, Macintosh, OS/2, NeXT, and so on) and programming talent is their most precious resource.

Neither Lotus nor Symantec will give away its best technology; *Lotus Spreadsheet for DeskMate* is an abridged version of *1-2-3*, Release 2.01 (no macros) and Symantec has ported its personal word processor *Q&A Write* (not *Q&A*).

Still, Tandy believes even modest programs from Lotus and Symantec running under *DeskMate* can help sell more hardware to small-business buyers who are easily intimidated at the sight of a DOS interface. Lotus and Symantec are likely to earn large returns from the low-cost packages and gain more name recognition in the largest computer chain in the country.

Yet Lotus is risking a lot with this deal. It's right in the middle of a tough battle to hold onto *1-2-3*'s status as

CONTINUES ON PAGE 64



TOP TEN SELLERS — A 5-Week History

Microsoft Excel seems to be making strong inroads now that *Lotus 1-2-3*, Release 3.0, is finally out. The relatively poor performance of the new spreadsheet may have prompted Lotus to push up its shipment of Release 2.2, which had been scheduled for a fall debut but began to ship during the last week of July (although not in sufficient quantity to make the Top Ten Sellers list).

Fifth Generation Software, still enjoying strong success with *Fastback Plus*, clearly has its eye on the high-flying utility programs from Peter Norton and Central Point Software: it just acquired the number-three program in that field, *Paul Mace Utilities*.

READING THE CHART

The Top Ten Sellers list ranks PC business programs according to their sales totals in the week ending July 29. The charts that appear to the left of each program name show how the program's sales ranked each week for the last five weeks. The hash marks at the bottom of each chart represent each of those five weeks, beginning with the week of June 26. Dramatic shifts in a particular program's ranking may be the results of sales promotions conducted by individual retailers. Seasonal factors, such as end-of-year budget purchase decisions, can also play a large role in the performance of a particular program in any period. More than 12,000 individual locations contribute to the list.

Sales information compiled by Ingram Software, Micro D, and PC Connections.

Rankings are based on net sales by unit; returns are subtracted from gross sales.

Pipeline

CONTINUED FROM PAGE 63

the leading productivity tool in American corporations and has just asked customers to decide between two upgrade choices. Now, it's suddenly decided people need a stripped-down version of the old version at a discount price (the *DeskMate* spreadsheet will sell for about $100 less than discounted copies of Release 2.01).

Symantec has nothing to lose with the new *DeskMate* version, and Tandy has a lot to gain, but Lotus gives every appearance of having started a fire sale.

Free at Last, AT&T Plans On-Line Services

Now that the federal barriers to AT&T's involvement in on-line services have expired, speculation is rampant about the company's plans. AT&T is likely to act fast. Look for a new information-sharing on-line service this fall. The service is more likely to target CompuServe than Prodigy, and will probably use AT&T calling card numbers for access and billing. Such services have recently been launched by a few regional Bell companies (see my review of NYNEX's Info-Look in this issue's After Hours section).

A T & T hasn't given any hints about its intentions yet, but analysts expect that whatever AT&T does, it can only increase the awareness and use of on-line information services. For example, it's estimated that Prodigy has already signed up 125,000 members without hurting its prime competitor, Compu-Serve.

> The new on-line service will probably use AT&T calling card numbers for access and billing.

Curiously, several days after the announcement by Judge Greene that the ban would expire, McDonnell Douglas sold the Tymnet public data network, a prime conduit for on-line access, to British Telecom for $355 million. GE is expected to divest itself of the GE Information Services business any day now. There's no direct connection between these sales and A T & T ' s newfound freedom, but more change will affect on-line services as competing entrepreneurs jockey for position.

Signposts

Faster page printers are going to start shipping soon, but you're going to see slower ones, too. This fall, Hewlett-Packard and Okidata are both likely to introduce printers in the relatively slow 4-page-per-minute class with discounted retail prices of about $1,000. Hewlett-Packard is building its printer around a brand-new Canon laser engine; Okidata is using a proprietary LED design.

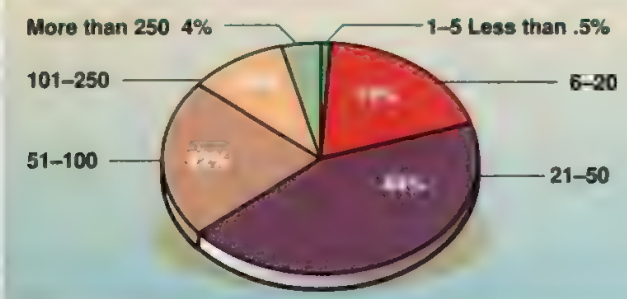
With programs getting larger and needing umpteen disks for installation, the CD may find a role as a cost-effective vehicle for distributing applications. Shareware and public-domain publishers have had some success with CD distribution, and now Microsoft is trying the concept with Mac applications.

The company's four top Mac apps (*Microsoft Word, Excel, PowerPoint,* and *Mail*) are being packed on a single $949 CD with bonus programs like Microlytics' *WordFinder* and Adobe screen fonts. If the CD bundle is successful on the Mac, it will certainly be tried on the PC, since a key trend among successful software publishers is the search for ways to extend the popularity of their top sellers to their lesser-known products and get higher prices for the same basic code. ■

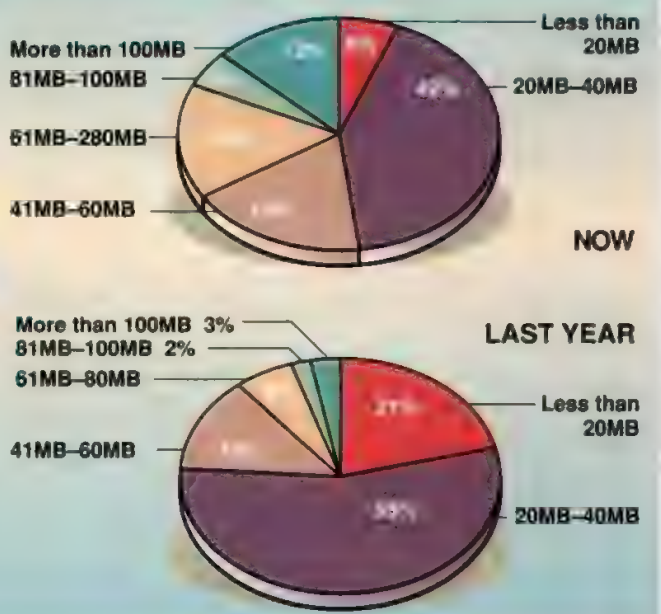
PC MagNet SURVEY

We had no doubt that people have been moving toward larger hard disks, but we didn't expect to find that PC MagNet callers had so quickly adopted the 100-megabyte disks and so quickly abandoned the 20-megabyte size. Just for fun, we asked about directory structure. Ninety-nine percent of the 658 respondents said they used a hard disk.

About how many directories and subdirectories are on your hard disk?



How many megabytes of storage do you have on your hard disk now? Twelve months ago?



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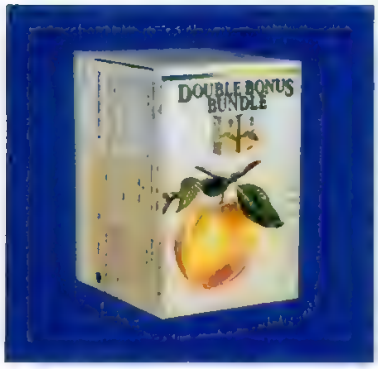

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- Payroll

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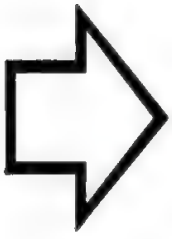
CIRCLE 358 ON READER SERVICE CARD

ClipArt from A to Z.



A is for Arrow

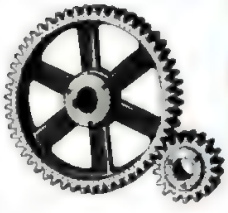
B is for Baseball

C is for Cartoons

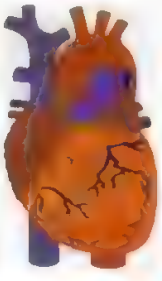
D is for Dinosaur

E is for Easter

F is for Flags



G is for Gears



H is for Heart

I is for Ice Cream

J is for Jet

K is for King

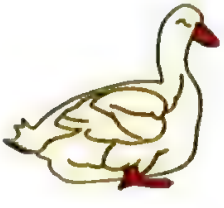
L is for Lobster

M is for Motorcycle

N is for Nutcracker

O is for Olympics

P is for Penguin



Q is for Quack

R is for Rocket

S is for Sale

T is for Taj Majal

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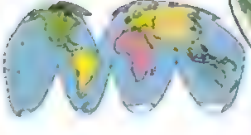
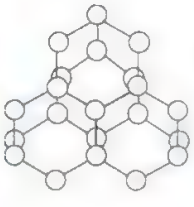


W is for World

X is for X-ray

Y is for Yacht



Z is for Zinc

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Bill Machrone

LANs have finally overcome their own inadequacies. Now they face a greater enemy: Unix.

It finally happened. 1989 was the year of the LAN. Local area networking has finally taken its rightful place as an integral part of the productivity solution for American business. Now that the basics are in place, the real work can begin.

The LAN industry is a wildly fragmented agglomeration of hardware companies, operating system vendors, application houses, and manufacturers of the bits and pieces needed to stick a LAN together and make it work. I'm not complaining; the LAN industry is an accurate mirror of the PC industry it serves, and a few standards help unite its members' efforts. But the difference between innovation within the standards and outright experimentation is thin at best.

At the same time, 386-based servers are facing competition from 386-based Unix machines in the race to replace the traditional minicomputer. Minor exceptions aside, here's how the DOS-versus-Unix decision shakes out: all of the good interactive and exploratory programs are DOS-based. If you're a knowledge worker, you want your machine to be a brain amplifier, a personal bandwidth increaser. So you use a PC.

However, until last year, all of the good centralized applications were Unix-based, at least if you factor in machine size and cost (we're not trying to replace mainframes yet). Accounting systems of the robustness and quality to make your auditing firm smile approvingly hadn't yet made it to LANs. Inventory control systems, too, were virtually nonexistent under DOS.

For this reason, midsize companies, especially manufacturers, are bastions of minicomputer strength. They have the lowest penetration of PCs per employee and per million dollars of revenue. They also have a strong commitment to traditional accounting systems and to computerized aids in manufacturing and inventory control, such as MRP (Material Requirements Planning). Not surprisingly, these applications are the mainstays of the minicomputer software market.

The manufacturing floor, in particular, with its heat, dust, oil, and vibration, has been a hostile area for PCs. Shop floors are some of the most regulated and controlled places on the planet. No one wants workers to worry about what-if scenarios when they're supposed to be busy building fire extinguishers. Terminal-based systems are a natural fit here. They're cheap, rugged, and utterly controllable in terms of what users can do with them.

A BETTER DEAL

PC manufacturers and VARs are making serious inroads into these midsize companies with Unix-based 386 boxes. These systems offer much the same performance as a traditional mini yet typically cost a tenth as much. And in some cases, the little boxes can even come with better service and support. Instead of going to the computer manufacturer for hardware service and to the various software companies for support, you can go to the VAR, who will take care of everything.

Some customers may object to the seemingly random collection of brand names in a

ILLUSTRATION JOHN LABBE

VAR-based system, especially if they get psychic value from color coordination and from seeing a name like *Digital* proudly understated on every piece of equipment.

But in this situation, Unix is generally a good choice. It was born to be terminal-based and configures easily to a wide variety of terminals. Backup and administration on Unix systems has become fairly routine. You no longer need a degree in computer science to

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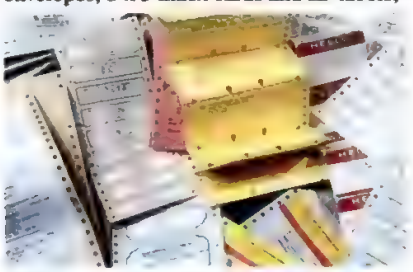

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Bill Machrone

keep the system running. For those canned applications, Unix gets the job done.

Moreover, Unix isn't as closed-ended as it once was. DOS-under-Unix solutions today range from running DOS windows in a Unix-based graphical environment to sharing DOS and Unix files transparently to using Unix as the host operating system in a LAN file server.

THERE'S WORK TO BE DONE

The LAN industry still has an enormous to-do list. In most LAN operating systems, for example, global naming services are weak, or else they require expensive add-ons. Without them it's hard—sometimes impossible—to build effective multiserver databases, e-mail systems, and other distributed processing applications. Similarly, bridges and gateways are usually add-ons that require more boxes and cables. Why is this necessary when there are open expansion slots in the file server?

Another big challenge facing LAN vendors will be the smooth integration of laptops into the network. More and more, the road warrior comes back to the desk and needs to plug into the LAN. Until now, the only solution was to use docking stations or to buy laptops with built-in expansion slots. Today, one company, Xircom, offers a diminutive device that plugs into the printer port and hooks up to Ethernet. That's progress, but does Xircom have the device drivers for all of the LANs and the laptops you want to use?

LAN operating system vendors and hardware vendors alike haven't thought hard enough about optical storage, either. You have to go to third parties if you want a CD-ROM or a WORM on your LAN. Everything hinges on that old bugaboo, the software drivers. They're a constant constraint if you want to change operating system vendors or even upgrade your existing network.

Finally, there's the file server itself. Until now, it's been nothing more than a PC with a big disk and maybe a tape drive. We're finally seeing the more enlightened manufacturers designing boxes with the special needs of file servers in mind: full 32-bit architectures, uninterruptible power supplies, integral tape drives, room for optical drives, far more drive bays than the norm, and gigabyte-plus capacities.

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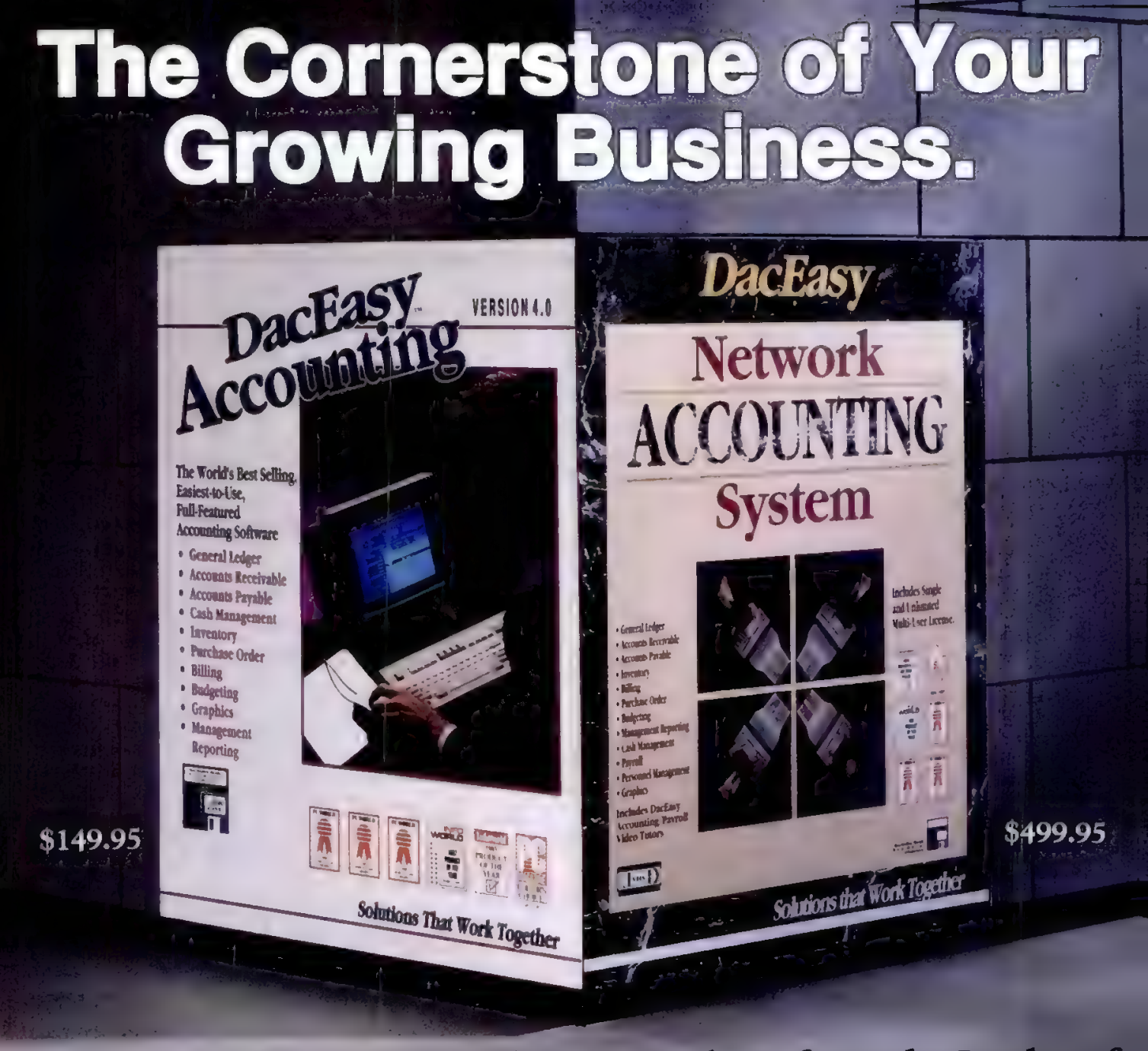

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This is an advertisement. We've contracted this space once a month. Even though it costs a ton of dough it seems like a great place to get some special messages across apart from our regular advertising. Besides, with John on the other side we're in great company.

You probably know Zeos as a direct marketer of high performance personal computer systems. Some people might call us a mail order house. Whatever you call it the pages of this magazine are full of companies willing to ship you something—all you have to do is call and give them your credit card number. But there is a big difference in what you get for the money.

There are some really great companies in this business. People that give good honest values and take care of their customers. Then there are those to watch out for. The problem is figuring out which is which.

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This incredible concept has shaken the industry. In the months ahead you will undoubtedly see others scrambling to keep up. People who never had Toll Free technical support will suddenly add it. People who never offered a 30 day money back guarantee will add it. And as sure as I write these words there will even be companies that copy our lead in providing 24 hour a day sales and technical support. These companies are followers.

"On July 15th Zeos made industry history. On that date, ZEOS extended our Toll Free Sales and Technical support to 24 hours a day, 365 days a year."

And that's good. For you. And even for those who end up buying from our competitors. Because with Zeos setting the pace, the entire industry benefits. When Zeos invented 24 Hour a Day Service we were not meeting competition, there was none. Quite simply, we did it for our customers. We did it for you.

So when it comes time to buy your next system, why not buy from the leader rather than those simply scrambling to keep up? Zeos will give you top notch systems that perform at the head of the pack. We'll back them better and we'll support them better. That's Zeos *Value*.

On pages 30 and 31, you'll find another Zeos first, *Computers Now!* If your order for either one of these two systems is in by 1:00 o'clock, we'll ship it the same day. I'd also like to call your attention to the new *Computers Now!* '386 system. It's our Editor's Choice '386-20 equipped with an 80 Meg SCSI drive. It's Hot.

Then on pages 300 and 301 we have our four system ad. I'd like you to take particular note of the Zeos 386SX. That's a great new machine that costs less than comparable '286 systems. You're not going to want to miss the Zeos '386-25 and 33MHz systems either. While the ad doesn't mention it, each includes a Turbo Cool power supply at no additional cost. The '386-25 has the 250 watt and the 33MHz comes with a 375 watt supply. Great Values.

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CIRCLE 388 ON READER SERVICE CARD

John C. Dvorak

The software compatibility dilemma: it's going to get worse before it gets better.

I bought Lotus 1-2-3, *Release 3, for use on my AT clone. It would not run. The Lotus PROMPT Hotline told me that* 1-2-3, *Release 3, was only thoroughly tested on actual IBM computers and on Compaq computers. Anything else, you are a test site! The clone manufacturer refused absolutely to offer any support whatsoever! Needless to say, I am very disappointed with them. Working with my dealer, we determined through trial and error that changing out the keyboard would correct the problem. Signed, Displeased*

The above letter is not unusual. More than ever, the behemoth software companies are abandoning the market at large to concentrate on making their software compatible with and optimized for IBM and Compaq only.

What we're seeing are bloated, out-of-control software companies that, despite millions of dollars spent on project after project, cannot do their job of making their software universally compatible. This is the bean-counter mentality that figures that you can't be cost-effective if you spend all your time writing drivers and doing compatibility testing.

I like to contrast these firms with WordPerfect Corporation. No wonder this Utah company owns the market in word processing. They have disks and disks of printer drivers, so many that they'll send you obscure ones from the factory for free if you phone their support line. Bean counters take note: WordPerfect makes oodles of money.

Meanwhile, we always forget that there is no such thing as a compatible 386 anything. Ninety-nine percent of the 386 compatibles are designed around the PC AT, a 286-based machine. So we're already off the mark by a wide margin. Next, we boost the speed to 33 MHz, and the timing factors are shot. The box slowly becomes a compatibility nightmare.

Making things worse, by vacating its leadership role, is IBM. Since the advent of the 386, IBM has gone off in its own proprietary direction, and the cloners have had to go it alone or find someone else to clone. Compaq seems to have become the leader, but, unfortunately, Compaq hasn't the engineering wizardry of IBM. Worse, all the clone makers are at the mercy of a couple of VLSI factories (Chips and Technologies is the leading one) for their logic arrays, and of two or three BIOS makers for their compatibility.

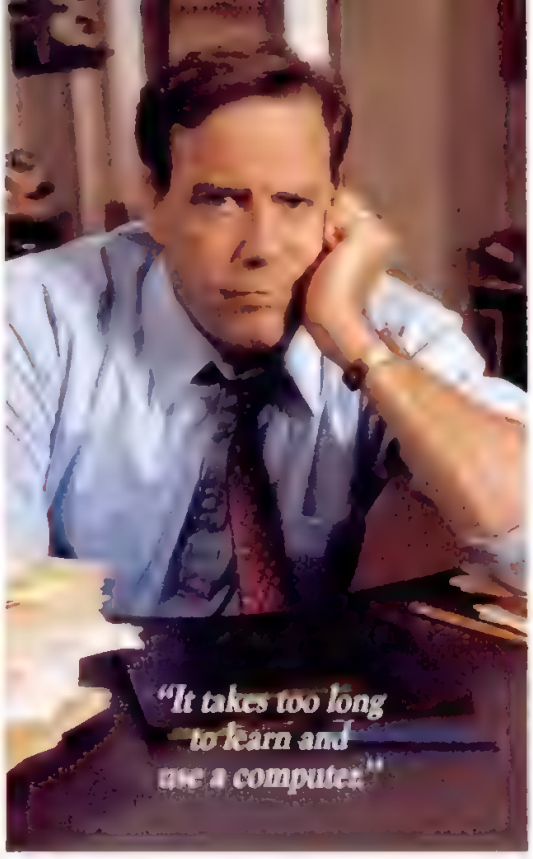
CERTIFYING COMPATIBILITY

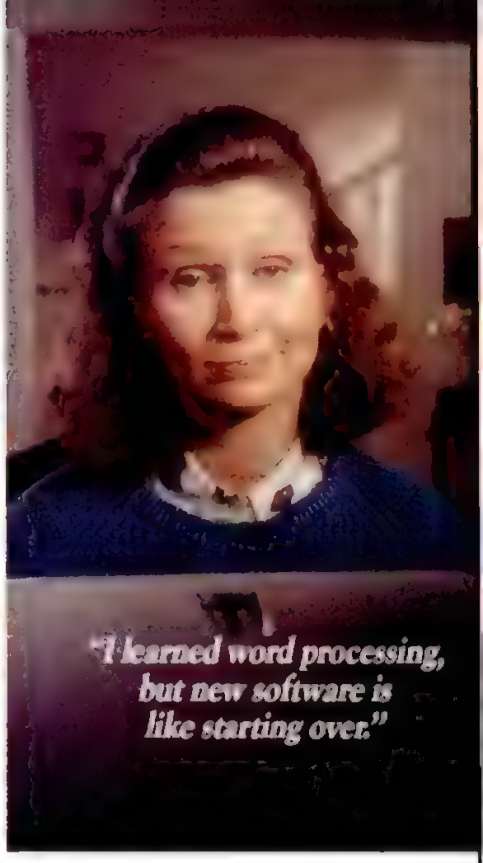
Given the advent of *Windows* and other complex programs, the old days of "Does it run *Flight Simulator*?" are over. The public needs a compatibility rating system. Phoenix, Award, AMI, and other BIOS cloners should form a consortium to do this, or else they should do this individually. They are the final checkpoint in a machine's development and as such they are the ones that can best determine overall compatibility.

They should set up a complex bank of tests to be paid for by the computer manufacturers. Every machine would then be certified as Class C (all current clones), Class B (which would require further testing), or Class A (which would have to prove to be 100 percent compatible with everything out there designed for Class A compatibility). Add-on keyboards would have to be rated too. And let's not forget software—some might be certified to run *only* on Class A machines, but the best would work on all three classes.

ILLUSTRATION: JOHN LABBE

The microcomputer industry had better start thinking in these terms soon, before we're flooded with 486 machines. Otherwise the golden years will be over and we won't know what hit us.





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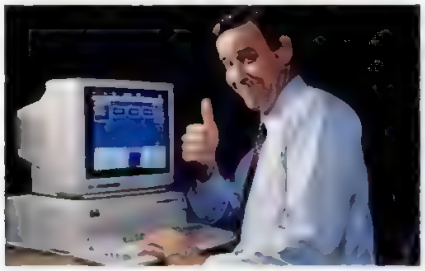

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John C.
Dvorak

Inside Track

486 mania is in full swing as vendors beg, borrow, and steal just to get one lone chip from Intel to make just one machine in a desperate effort to get on the **bandwagon.** Already people are saying they'll have machines out "tomorrow!"

Most designers say that when the 486 is run in its so-called "burst mode," it **outperforms all the RISC chips** on the market, if for no other reason than that it can do complex instructions at 15 million instructions per second. I suspect that the RISC/CISC debate will go back into the streets this year, with bottles tossed and the cops called out.

Here are some things to note. The first 486s will run at 25 MHz; 40- or 50-MHz 486 chips will not be in production for at least a year. Apparently, there just aren't any coming off the lines. If you don't know this, the way a high-speed chip is made is a three-step process: (1) It's designed. (2) It's manufactured. (3) It's tested. The testing determines which bin it will be tossed into. The ones that pass the high-speed tests go into one bin. The ones that fail are sold as slower chips. But in theory, they should **all be the same.**

> A 486 running at 15 MIPS; a $299 10-MHz 8088; new market segmentation; desktop T-shirt manufacturing.

Some computer makers will **cheat the devil** by boosting the chip speed on their own and assume that the reason for failure at the Intel factory was trivial. This is a **dubious practice** at best. With Intel repricing the 80386 line, maintaining a solid backlog of 486 chips, and **boosting the performance** of the 8088, I expect the market to fall into an interesting stability in 1990.

It should look something like this: The standard 386 will be the 25-MHz model, with the 16- and 20-MHz chips **disappearing.** The 33-MHz 386 will be supplanted by the 486 (probably stabilized at 25 MHz), which will approach 12 or 15 mips—double or triple the performance of the available 386 chips. The 33-MHz 386 will be a **white elephant** chip.

There should also be a **brisk market** for the **crazy** 386SX, but that will be kept alive only as an attempt to **ruin** the 286 business. It should be a white elephant soon too.

The low end of the business isn't going to disappear either. The emergence of the 10-MHz 8088, which gives AT performance to el cheapo XT clones, makes it look like **8088 code will never die.**

Now I hear about some chip sets that will allow a cloner to take the **super-turbo 10-MHz 8088** and build a computer designed to sell for around **$299.** This should cause market segmentation like nothing we've ever seen in the industry. The 386 and 486 power machines can no longer be held back by 8088 code and will break away in 1990 or 1991, creating **two distinct PC markets.** You'll notice how IBM preannounced a 486 just to make sure that people know which camp it's joining. IBM doesn't want to have anything to do with the 8088 market and the **upcoming mania.**

The **fly in the ointment** in this dual market is the fact that Intel can't do CMOS like Harris (a 286 licensee) can do CMOS. This means that 12-MHz, 16-MHz, and maybe even 20-MHz white elephant 286 chips will continue to be sold into the performance segment of the laptop market. The **power-hungry** Intel chips are never found in a battery-powered machine. Hopefully, as Intel rolls out the 486 (a chip, I believe, that will become the most popular microprocessor yet invented), it will grant **Harris** and other CMOS makers a belated license to second-source the 386. Intel **owes it to the public** to allow the 386 to be the heart of a new generation of laptops. End of update.

Laptop Dept.: Did you know that the LCD screens that come with laptops all have a register that controls the cursor, allowing the machine to display any kind of cursor effortlessly, without software patches? Then why don't all portable computer makers wise up and display a **large readable BLOCK cursor** instead of that hard-to-find little underline? Are they that cowed by IBM standards? "Gee, but that's the way IBM displays its cursor."

Truly Interesting Apparel Dept.: An entrepreneur friend of mine, Dave Furano, returned from his travels abroad and has put together a mixture of old and new technologies that will allow you to take the output of a **laser printer,** insert it against some weird plastic, pass it through a cheap thermal device, and produce a ready-to-use **silk-screen master** instantly. The cost of the screen is about 2 or 3 dollars, compared with the $500 or so you'd have to pay using the old photo process. Now you can crank out T-shirts on a desktop. **Desktop T-shirt manufacturing.** I was impressed.

Furano was one of the founders of one of the largest printed T-shirt manufacturers in the world, Winterland Productions (now owned by MCA), and he has always been looking for some cheap way to produce silk screens. If you're interested in this process, give him a call at Furano and Associates, 221 Oak Crest Rd., San Anselmo, CA 94960; (415) 453-7276; fax: (415) 453-7279.

And for you computer artists, Furano tells me that Winterland Productions is **desperately looking** for any and all **computer art** that can be used on T-shirts, album covers, and promotions. They pay pretty well, I'm told. You can call him for more information. **He'll make you famous.** In the meantime, I believe I'm going to crank out some Inside Track T-shirts and ties! ■

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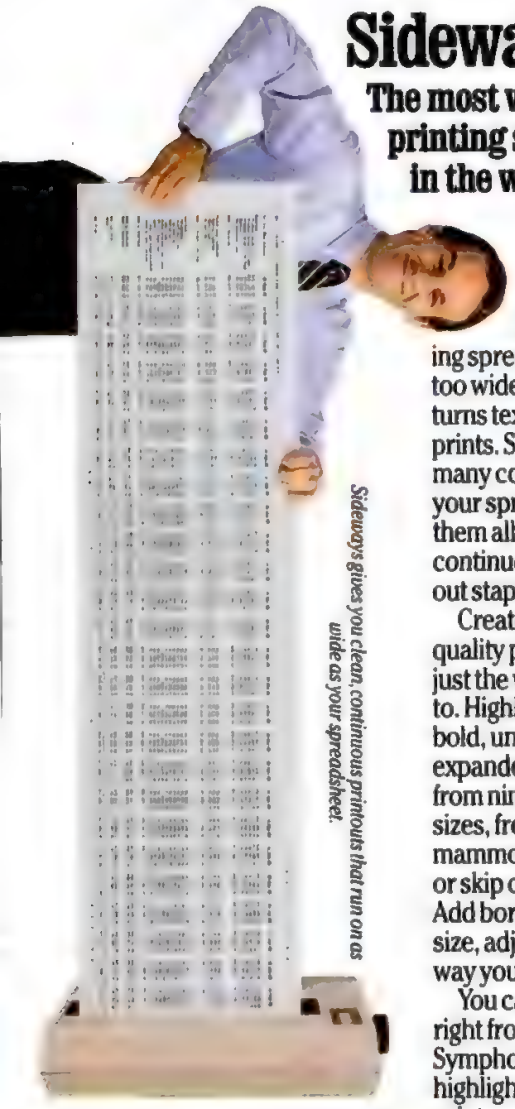

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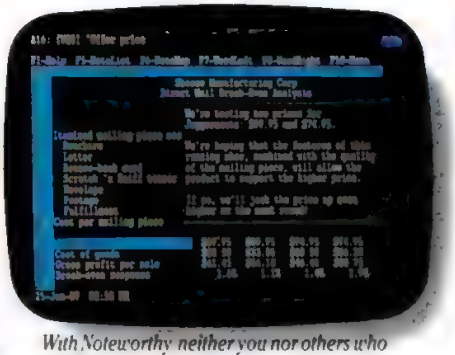

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Jim Seymour

Upgrades are never much fun for corporate micro managers. But Lotus hasn't made it any easier for them to upgrade their sites to Release 3.0 of 1-2-3.

The people who manage the fleets of PCs used by America's largest businesses look at software upgrades a little differently than PC enthusiasts do. When we hear about an upcoming release of a product we already use, we get excited about the new features and send in our 50 bucks. And as soon as we get the package, we rip it open and put it on the hard disk.

And we like that.

But PC coordinators (or micro managers, or whatever titles they hold) generally see software upgrades as a huge pain in the ass.

And they're right.

When we buy a new program or a set of upgrade disks, it's usually an easy matter to install the software and then either work through the tutorial or use the brute-force ("What manual?!") system for learning the program. If we run into things we can't figure out, we go back to the manual, or else we call the software publisher's help line and listen to that nice music while we're sitting on hold.

That's not how it works in businesses with hundreds or thousands of PCs. Someone has to review the upgrade and decide whether it's worth the bother. Someone has to count noses in the company's PC-user population to see how many would benefit from the upgrade, or else to decide that everyone should use it for the sake of standardization. Someone has to find out which version of the program is being used now on each of those PCs. Someone has to satisfy the software vendor that the company is entitled to all those copies of the new program at the upgrade price—and maybe try to negotiate a volume price on the upgrades.

Then someone has to go round and install all that software. Because long experience has shown micro managers that letting average business PC users install their own upgrades is an unmitigated disaster.

Of course, those PC users don't want to be disturbed, or to be without the use of their PCs for the time it takes to install the new software. So maybe the PC support staff will have to spend some long nights installing upgrades after everyone has gone home.

And then there's the little matter of teaching people how to *use* the upgrade. . . .

You can see why corporate PC-support people take such a dim view of software upgrades. And having been through the upheavals of a couple of big, messy upgrades in the last year or so—last summer's move from *WordPerfect* 4.2 to 5.0 still sticks in the craws of a lot of micro managers—many were really apprehensive about this summer's upgrade from *1-2-3* 2.01 to 3.0. With cause.

IS IT WORTH THE TROUBLE?

As the most widely used piece of software in most companies, *1-2-3* has become a kind of lingua franca in the corporate world. Anything that changes how it works or how people use it causes big ripples. And because people rely so much on *1-2-3*, PC coordinators can't risk problems; too many departmental budgets, customer lists, planning models, and so on reside in the *1-2-3* worksheets on users' PCs.

Two years of publicity about this super *1-2-3* have left micro managers apprehensive.

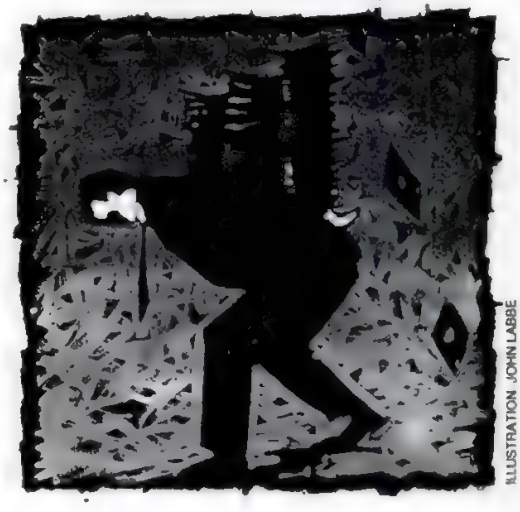

ILLUSTRATION JOHN LABBE

Would it be worth the huge cost of changing over? If they decided it wasn't, or was worthwhile for only some users, could they resist the inevitable pressure to upgrade everyone? Could any companywide upgrade of that magnitude possibly go smoothly?

Then their fears came true.

Lotus tried to do the right thing in many ways for corporate PC managers; for example, by making it easy for them to buy upgrades in

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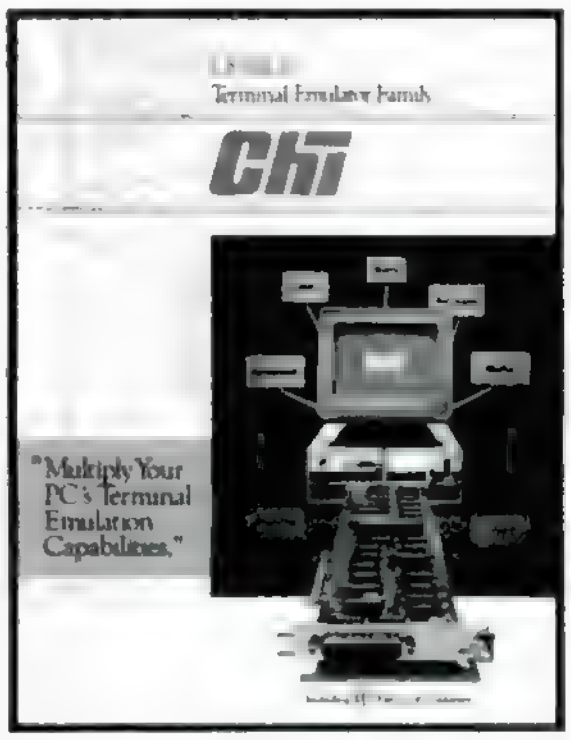

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CIRCLE 395 ON READER SERVICE CARD

Jim Seymour

quantity. Unfortunately, the complications of the software itself did them in.

Part of the problem is that *1-2-3*, Release 3.0, requires at least 1MB of RAM: 640K of conventional DOS memory plus at least 384K of extended (not expanded) memory. And part of it is the ghost of Bad Ol' Lotus from the copy-protection days.

Lots of PC AT clones now have 1MB of RAM installed. But many of them reserve that extra 384K for "system enhancements," which usually translates into shadowing the ROM BIOS and video RAM, and a little disk caching. So just having 384K beyond the base 640K isn't enough: it has to be 384K of *available* RAM. And expanded memory doesn't count: this has to be extended memory.

All of which means that memory upgrades will usually be required. At a minimum, even on PCs equipped with EMS boards that allow you to set aside some of their memory as extended memory, jumpers will have to be reset, and the soft-switch options in the CONFIG.SYS files probably have to be changed, too.

I won't even mention the complications for users who have converted some of their extended memory to a RAMdisk or disk cache. And of course the specifics of these complications vary from machine to machine. This wasn't going to be a 5-minute upgrade, was it?

But it gets worse.

Lotus has dropped copy protection from *1-2-3*, Release 3.0, but the company has replaced it with a moronic scheme known in the software business as a "guilt screen." This is the routine where you're asked for your name during installation; that data is written to the master floppy disk—and appears on every installation of the software from that disk.

Guilt? People who are going to steal software don't worry about guilt, and they don't bother to cook up technical wizardry to escape using their names. They just type in "John Q. Public," or "Mario Lanza," or some other pseudonym, and go about their larcenous ways.

Yet in the effort to defeat those imaginary efforts at technical end runs around this name-imprinting routine, Lotus has managed to produce an installation program that hangs if you have added such an innocent and commonplace little touch as a disk cache program running on your PC.

Of course there's no mention of that little problem in the documentation. And if you call Lotus in despair, the only response you'll get is "The installation program does not support cached floppy disk drives."

So instead of a working installation, you get a prompt that says the disk you've just taken out of Lotus's shrink wrap is not an original disk. "Please get the original disk, you thief," it implies, "and then you can continue the installation."

Lotus deserves a lot of credit for dropping copy protection. Unfortunately, the same latent paranoia that led the company to keep copy protection long after everyone else had dropped it apparently resurfaced when Release 3.0 was being readied for release; hence the guilt-screen approach. And the ensuing difficulties for an unknown but probably significant number of Lotus customers.

Back to our earnest micro manager.

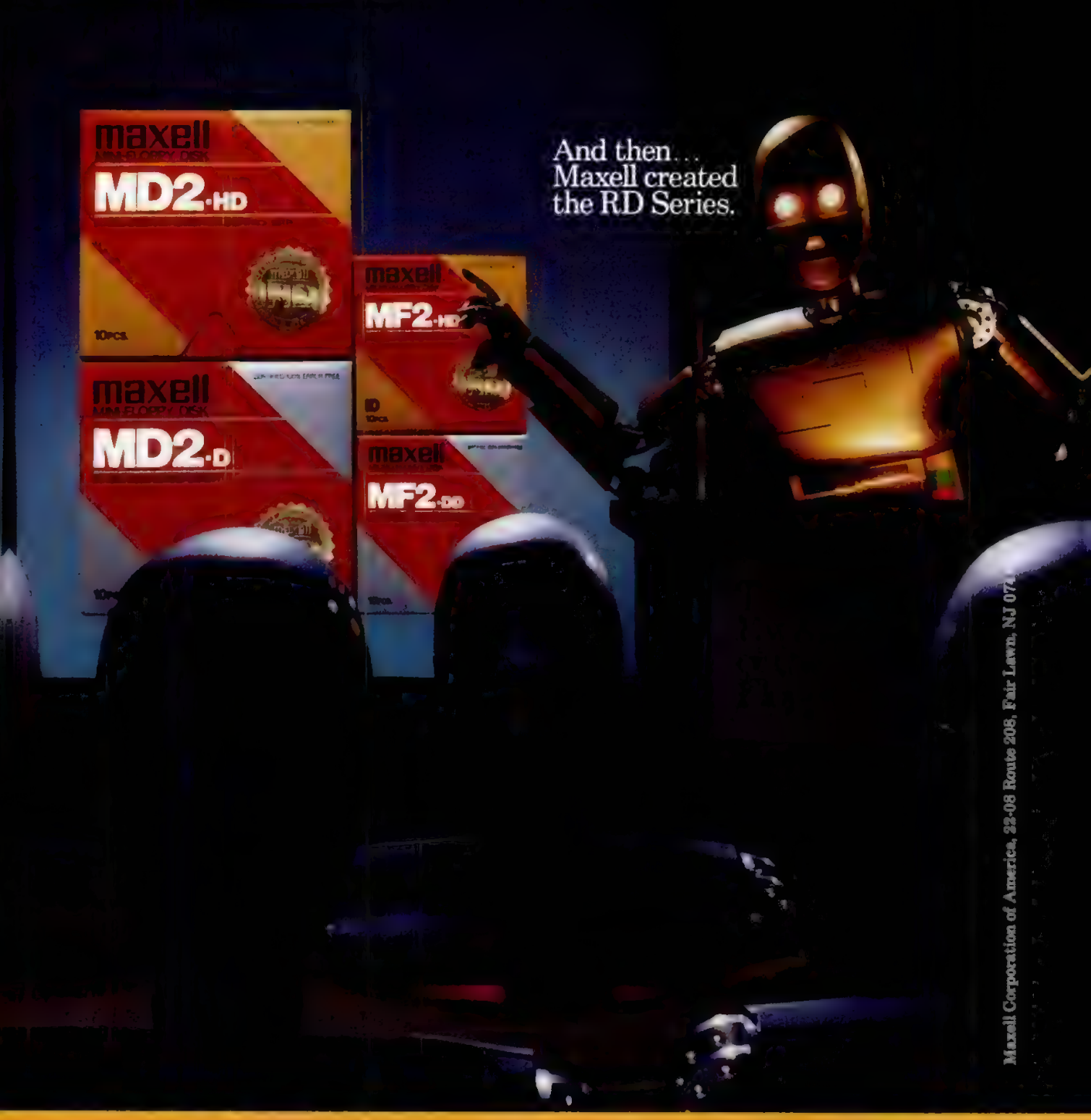
He's sitting at his desk, wondering whether he should upgrade his users to *1-2-3*, Release 3.0. A lot of those users—many of whom don't know much about the difference between Release 3.0 and their current copies of Release 2.01, nor anything at all about the pending release of Release 2.2—are pounding him with calls and memos. They've gotta have the latest and greatest, so if it's new. . . .

He realizes it will cost a bundle to upgrade to Release 3.0, especially with the extended-memory requirement. He knows that software-plus-hardware upgrades are the messiest of all to manage. He knows that the variety of kinds and configurations of PCs out there in the company means he's going to spend a lot of costly staff time upgrading those machines to Release 3.0.

But he bites the bullet, orders the upgrade, stocks up on add-in memory boards, learns the ins and outs of configuring memory boards to support a mix of extended and expanded memory, figures out how to rejigger the memory management programs in use in the company, and goes forth to start the installation.

He then finds that the upgrade's installation bombs out on the machines of users who've added such intelligent touches as caching routines. These are exactly the kind of users most likely to be critical of him, his work, and his competence.

Is it any wonder that micro managers no longer jump automatically at every upgrade for their approved-and-supported programs? Would you? ■



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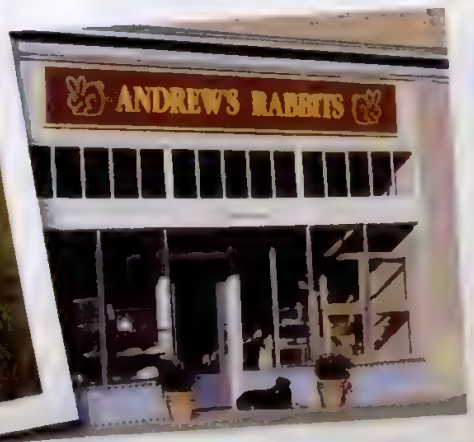

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CIRCLE 317 ON READER SERVICE CARD

William F. Zachmann

A storm is on the horizon, and the computer industry is square in the middle of its path.

The signs of economic trouble ahead are getting to be hard to ignore. Not just the personal computer industry, but the computer industry as a whole and, indeed, the general economy, seem to be in for a spell of bad weather.

All of the talk earlier this year about a "soft landing" for the economy is starting to seem like little more than an attempt to whistle past the graveyard. The dreaded "R" word (recession) has made its way into normal, everyday speech again.

And it's not just the traditional mainframe and minicomputer vendors that are feeling the pinch, but a growing number of PC hardware and software vendors, too. Disappointing earnings are more common than the reverse this year.

Chances are good that this isn't just an ordinary rainstorm brewing. Rather, it looks like hurricane season for the industry and the economy. We may soon need to board up the windows, pile up the sandbags, and head for the cellar to wait out the storm.

I hope I'm wrong. But I'm pretty sure that my forecast is going to prove correct.

I haven't any doubt that we are in the midst of a fundamental technological transition in information technology. The accelerating trend away from traditional mainframe and minicomputer systems built around proprietary architectures toward increasingly standardized, microprocessor-based alternatives is bringing radical change to the industry.

During the 1980s, the microprocessor revolution largely existed alongside traditional computers, primarily in the form of PCs used as personal productivity aids. Important as they have been as tools that allow individuals to work with words or numbers more productively and efficiently, PCs haven't had much effect on how businesses do "real" computer applications until quite recently. Mainframes and minicomputers still handle most heavy-duty information processing.

That will change radically during the 1990s, however. At first gradually and then rapidly, microprocessor-based systems will begin to replace traditional mainframes and minicomputers. By 2001, microprocessor-based systems will dominate information processing.

This trend involves more than just personal computers, of course. Network servers, multiuser systems based upon standard microprocessors, and larger, more powerful, multimicroprocessor-based systems operating as number crunchers, database servers, or transaction processors will all play their parts. Together, they will make traditional computers as obsolete as the horse and buggy and the steam locomotive.

A GAP IN DEMAND

The present period is a sort of interregnum between the explosive growth that took place in the 1980s of personal computers for individual productivity and the real action that will develop during the 1990s, replacing mainframes and minicomputers for enterprisewide systems. Consequently, though personal computer sales growth is slowing, the momentum of microprocessor-based systems as mainframe replacements hasn't really developed yet.

ILLUSTRATION JOHN LABBE

Some market researchers claim that, based on the total size of the white-collar working population, we've a long way to go before we reach the saturation point in the personal computer and workstation markets.

But in fact we are much closer to the limit of the realistic demand for personal computers than any of these forecasts suggests. The researchers' predictions are based on erroneous assumptions about how large the potential

William F. Zachmann

population of personal computer users really is. The U.S. PC market, for example, is much closer to becoming a replacement market than they assume.

At the same time, although personal computers are already replacing traditional systems for many applications, microprocessor-based alternatives to traditional systems aren't mature enough, nor well enough understood by most business organizations, to pick up the slack. They are, however, developed enough to create serious demand problems for traditional systems. The ranks of old-line mainframe and minicomputer vendors grow thinner year by year. More will disappear in the months and years ahead.

In themselves, these internal factors mean that there will be tougher times for the majority of vendors in the computer industry. Personal computer vendors face slower growth and lower profits. Traditional mainframe and minicomputer markets are not merely slowing—they are headed for absolute declines. And while some individual vendors with more-powerful microprocessor-based systems are doing well, collectively their successes don't yet make up for the relative losses of the others.

Add to this the increasing probability that the general economy is getting sick, and you've got a very unpleasant and potentially dangerous combination.

Companies and individuals who use computers aren't likely to escape the storm either. Since the downturn in the computer industry is likely to be in sync with a downturn in the economy generally, the misery won't be confined just to computer hardware and software vendors.

> The catchphrase for the start of the 1990s might just be "Buddy, can you spare a megabyte?"

For users, however, there may be a silver lining to these storm clouds. True, tough times are likely to put a severe squeeze on what are often already-pinched budgets for computer acquisitions. Spending on computers is hardly exempt from the general cost cutting that businesses do during hard times.

But slack demand combined with plenty of inventory and production capacity will likely drive prices down considerably. A year from now, that superfast 386- or even 486-based system with megabytes of memory and lots of disk storage will probably be a good deal cheaper. So we'll have the consolation of knowing that before long we're going to get more for the money we spend on hardware and software.

The real trick, however, is to be sure we've got some money to spend. Otherwise, the catchphrase for the start of the 1990s might just be "Buddy, can you spare a megabyte?" ■

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– PC Magazine September 12, 1989 Issue

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CPU	8088	80286-12	80286-16	80386-20	80386-25
Speed MHz	10/4.77	12/6	16/6	20/8/6	25/8/6
Bus	EISO	Phoenix	AMI	Phoenix	Phoenix
Norton SI Rating	2.1	13.4	19.01	23.0	30.5
Wait State	0	0	0	0	0
Standard Memory	640K	1MB	1MB	1MB	1MB
Shadow Memory	-	-	-	64K	64K
Cache Memory			-	32K	32K
Co-Processor Slot	Yes	Yes	Yes	Yes	Yes
Expansion Slots (8bit)	8	2	2	2	2
Expansion Slots (16bit)	-	6	6	5	5
Expansion Slt. 32 bit	-	-	-	1	1
FD HD controller	W/HD	Yes	Yes	Yes	Yes
Device Bays	4	3	3	3	3
Serial Ports	1	2	2	2	2
Parallel Ports	1	1	1	1	1
Game Port	1	1	1	1	1
Clock/Calendar	Yes	Yes	Yes	Yes	Yes
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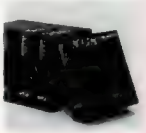

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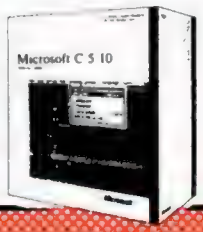

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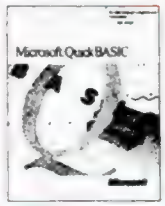

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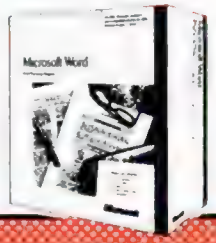

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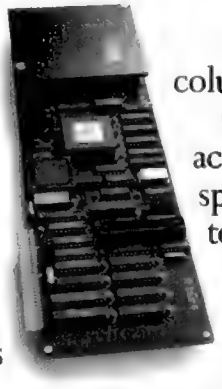

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CIRCLE 247 ON READER SERVICE CARD

Copyrighted materia

Stephen Manes

Ready for a tour of OS/2 and Presentation Manager? Bring along a mouse, a big, fast hard disk, a whole lot of memory, and a healthy dose of skepticism.

Ah, the columnist's life! Threatened with hostilities better left unpublished in a family magazine! Charged with the most heinous of blasphemies: making fun of an operating system!

Unfair, unfair! Why, this very column is being written with the help of the fanatics' darlings, Presentation Manager (pronounced "Pee Em") and OS/2 ("Oh, A Stew!").

But the research department has informed me that both readers of this column tend to be tight-fisted skeptics who—I find this hard to believe, but statistics do not lie—*may not yet own machines that can run OS/2!!!* And who, therefore, may never have had a chance to see PM in action. So I have decided to offer a personally guided tour of the operating system that has been endorsed by IBM, Compaq, Zenith, HP, and Jerry Lewis.

Excuse me—perhaps I am giving too much credence to industry rumor. At this writing Mr. Lewis has not officially become the celebrity spokesperson for OS/2; the Nutty Professor may yet join forces with the Unix crowd. But after Apple's Cavett, Tandy's Asimov, Commodore's Shatner, TI's Cosby, and Atari/IBM's Alda, what other credible name is left?

Installing PM on your computer is at least as much fun as watching a telethon. Simply clear 8 megabytes of space from your hard disk, add a few megabytes of memory to your machine, and borrow five disks from a colleague with the same hardware as yours.

No! Forget I said that! You should *of course* rush right to your dealer and fork over 300-odd dollars for your very own copy of this elegant operating system, which is gaining users every day because many versions (*not* the IBM one, though) come complete with the fascinating and hilarious "Bricks" game that delights kiddies and reminds parents of old Atari game machines.

The PM installation program is simplicity itself, except for a few questions intended to make no sense whatsoever unless your name is Charles Petzold. Simply accept the defaults, and when you are done you will find 8 megabytes of disk space chockablock with new directories and files such as HARDERR.EXE (apparently a special file that makes system commands especially difficult to figure out) and CONFIG.OS2, which includes such clear, easy-to-understand, new-look commands as FCBS 16,8 and MEMMAN=SWAP, MOVE.

Confused? With OS/2's advanced on-line help system, you simply click on "Help" or press F1—and *then* figure out which of the four manuals has the info you need! Say you wonder what the file SPLDVWRK.EXE does. You'll find no mention of it anywhere on-disk or in print, so just go ahead and delete it.

GREEK TO YOU

Ready to boot up? PM will whitewash your screen and display something that looks like an egg timer. This is actually an *icon* (from the Greek "I con," meaning "to pull golden fleece over the eyes"). This particular icon is a direct descendant (from the Latin "descendare," meaning "to rip off") of an hourglass icon used on the hugely successful Apple Lisa.

When the egg timer disappears, you'll see three new icons at the bottom of the screen.

ILLUSTRATION: JOHN LABBE

At the left is a black square with the white letters DOS cut out of it, demonstrating the basic superiority of icons to mere text. Double-clicking here lets you run (one at a time) any of literally dozens of popular programs that don't require expanded memory and don't use tricks to optimize such trivial things as speed.

Next comes an icon that looks like a box with decorator Kleenex emerging from it. If you move the mouse pointer here, hold down

the left mouse button, and "grab" the paper immediately after sneezing, a special program will electronically disinfect your monitor *from the inside*.

Oops! I have inadvertently revealed an undocumented feature not yet available. For now, the Kleenex-box icon simply reveals a hidden label, "Spooler Queue Manager," when you click on it just right. As yet it performs no useful function.

ACTION JACKSON

The third icon graphically depicts two streamlined playing cards overlapped in a vaguely lewd way. Depressing the left mouse button reveals the hidden name of this icon—"Action Jackson."

Excuse me. I mistakenly brought up an interim beta version. Corporate America demanded a name change. The next iteration, the charming "Taskmaster," was revised to the business-schooled "Task Manager." The original three-piece-suit-with-whip icon was scotched at the last minute, but Microsoft did retain the sadomasochistically evocative Ctrl-Esc combination for keyboard access.

The "Start Programs" window uses the jaggedy pseudo-Helvetica proportional font that's standard in PM. Indeed, one of the many nice things about the graphical user interface is its absolute consistency. For example, it is always the case that you can close any window just by double-clicking the box in the upper-left-hand corner, except when you can't.

The on-line help always delivers useless general information until you mouse around in the index. Error messages are invariably preceded by obscure characters such as PMV1004, thereby producing consistent annoyance. Supplied drivers support every printer imaginable, provided that your imagination is limited to the products of the International Business Machines Corporation. Consistency? Why, this system was pureed in a Cuisinart!

Yet a *foolish* consistency, as many recent politicians have pointed out, is the hobgoblin of little minds. So with every copy of OS/2 come many state-of-the-art utilities (such as a program called CHKDSK, which *actually tells you how much disk space you have left on your machine!!!*) that do not offer pretty, proportionally spaced PM windows. Instead, you get white-on-black fixed-width characters in a "text window." This special, new, advanced high-performance technique is called "character-based"; as yet, Macintoshes can't run character-based applications, nyaaaa-nya-nya-nyaaa-nya.

The character-based "System Editor" comes free with OS/2 and PM, and it wisely avoids adherence to PM or SAA or any other known standard. You press F10 for the menus, not the Alt key you'd use in PM. Mouse? What's a mouse? To move the cursor to the bottom of the screen, simply press Shift-F9, type CURSORBOTTOM, and tap the Enter key. *I am not making this up!!!*

In fact, I'm using a character-based application to create this column. It's called a word processor, and it runs great in the "MS/DOS window," which is what used to be called the "Compatibility box" before it was rechristened to avoid public snickering. Sure, I could run it in DOS itself, but this way I can switch over to Bricks *without even saving my text file!*

Making fun? Me? Hey, someday, maybe I'm going to *live* here! ■

CIRCLE 728 ON READER SERVICE CARD

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CIRCLE 742 ON READER SERVICE CARD

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THE PACKAGES BEHIND THE PRESENTATION

PHOTOGRAPH: JOCK LEUNG

This year's crop of upgrades and overhauls vies with newcomer *Xerox Presents* to keep up with the demands of increasingly sophisticated presenters.

by Robin Raskin

Satisfaction is fleeting, especially in the PC graphics industry. A year ago (September 27, 1988) we looked at presentation graphics software and were satisfied with packages that let anyone with a modicum of skill create an aesthetically pleasing chart. One year later we want more. Being able to create a single respectable image is terrific if you're into limited-edition prints, but anyone who goes to battle with an audience knows that one fancy slide does not a presentation make. The key to success is a well-organized, consistent, and image-laden presentation.

We've validated ad nauseum the argument that visuals help get the point across. The now-classic Wharton School and 3M studies, which investigated the effects of visual presentations on an audience, give us hard data (in chart format, naturally) confirming our longtime

suspicions that graphics make the point faster and more persuasively. Psychophysicians have laid down some ground rules for the effective use of color. Graphic designers have kept their noses to the grindstone to create software that enforces the rules of good design. By degrees we're becoming more confident that our charts are readable and informative, our text attractive, and our diagrams up to the state of the (object-oriented) art. Charts are still not all that easy to create, but the results of the effort are looking better and better.

PRESENTATION GESTALT

Now that the baby steps of simple charting have been mastered, this year's presentation graphics reviews focus on tools for the presentation gestalt. These packages all aspire to be one-stop shops for all your presentation graphics needs. They help you create images, organize them, and then give you more control when you display them.

The software's emphasis is shifting from letting you create one image to helping you prepare an entire, cohesive-looking presentation *and* the speakers' notes and handouts to go with it. Ideally, these packages will not only house the images, they'll do the housekeeping. They have tools that consolidate the images into groups. Members of a group can have shared attributes—such as being displayed on the same graduated color background with a corporate logo in the upper-left-hand corner—so that your presentation looks consistent and professional, thanks to design tools such as artistic backdrops and style templates. Predefined color palettes and VGA displays (256 colors in the best packages) let you come off looking like the Renoir of the presentation crowd. And these packages spawn the accoutrements of the live presentation trade—audience handouts, speakers' notes, and self-running demo disks.

Finally, these one-man bands of presentation can emcee the show as well. Choose your weapon from the vast array: 35mm slides, color transparencies, color hard copy, on-screen slide shows, or even desktop-published material. Today's graphics program can funnel your image to the proper device.

PLASTIC SURGERY

Except for *Xerox Presents*, all the packages reviewed—*Lotus Freelance Plus*, *Graph Plus*, *Harvard Graphics*, *The Graphics Gallery Collection*, *Kinetic Graphics System* and *SlideWrite Plus*—are old-timers; previous versions of these veterans have been assessed in this magazine before, most recently in last year's graphics blockbuster (September 27, 1988). In the never-ending battle to retain market share, the vendors of these venerable packages have added some organizational panache, beefed up their on-screen display prowess, and tossed in a good helping of import/export and device support. None of them do all this seamlessly, and you are often left with a distinct finger-in-the-dyke feeling.

Over the last few years, *Harvard Graphics* and *Lotus Freelance Plus* have tussled continuously for supremacy in the top two market-share slots. Recently *Harvard* pulled into the lead, but real power users are complaining of arrested growth, since there has not been a major upgrade in a while. A new version is in the works, and according to spokespersons at Software Publishing Corp. it will incorporate enhancements in both drawing and connectivity.

Freelance Plus underwent a major upgrade this past year. It emerged having nearly outgrown its 640K environment (with no support for extended memory), but the improvements to the program are significant. Right now, *Freelance* gets the nod over *Harvard*, but "it ain't over till it's over."

Micrografx's *Windows*-based *Graph Plus* continues to provide heated competition for both of the old standbys. *Graph Plus*'s new version increases its presentation prowess but doesn't do much to expand its charting and drawing capabilities (which were already quite good). All of the other packages can create sophisticated graphics, but the revisions and additions that enable them to do this can seem like Band-Aids.

Venerable packages have added some organizational panache, beefed up their display prowess, and tossed in some import/export and device support.

The new kid on the block, *Xerox Presents*, is a disappointment. In theory the *Windows*-based program's automatic support for speakers' notes, handouts, and on-screen presentations—all in appropriate fonts—sounds like a presenter's nirvana. In reality the current PC technology isn't fast enough or spacious enough to accommodate the grandiose program design, and the program's excessive use of pop-up dialog boxes is maddening.

PROCESS VS. PRODUCT

You can churn out pretty pie charts and brilliant bar graphs using any of the seven packages we reviewed and many we didn't review—most notably *Draw Applause* (which was in the process of being revised), *GraphStation* (which wasn't received in time to be reviewed), and *Pixie* and *Mirage* (which didn't pass our filter). We chose to review products that emphasized the presentation part of Presentation Graphics. Our feelings about presentations translate into stringent criteria that a package had to meet in order to qualify for review. Each package had to

- **output** to at least four of the following devices: a film recorder, a color printer, a pen plotter, a laser printer, a dot matrix

OUR CONTRIBUTORS

Kellyn Betts is an associate editor of *PC Magazine*.
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Robert Johnson is the product manager for the graphics category at Corporate Software. He evaluates graphics packages and frequently discusses the merits of their features with software vendors and corporate users.
Alfred Poor is a contributing editor of *PC Magazine*.
Robin Raskin is a contributing editor of *PC Magazine*.
Luisa Simone is a contributing editor of *PC Magazine*. ■

For the features section of this issue, the associate editor was Kellyn Betts, and the PC Labs project leader Robert W. Kane.

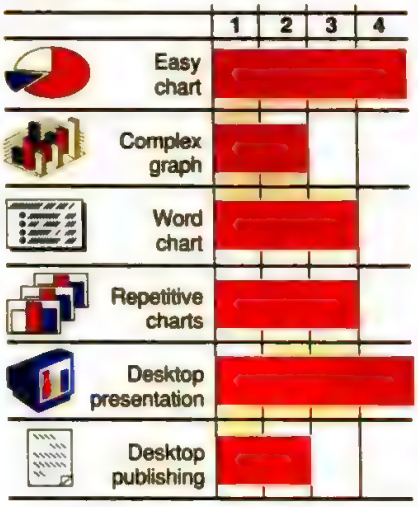
SUITABILITY TO TASK

The presentation graphics packages reviewed on these pages contain hundreds of features, enabling them to create almost any kind of chart or graph you could conceivably want or need. Not all the packages create each kind of chart with equal finesse, however. To help you determine which does what best, we created a group of six tasks that mimic the most common uses of the packages.

PC Magazine required its reviewers to complete these tasks using each product they assessed. The reviewers rated the products' ability to perform each task using the rating criteria we developed. These are subjective ratings, and it's important to stress that we designed them to give you an idea of each package's strengths and weaknesses in terms of how well it performs certain selected tasks. A package may receive superior suitability-to-task ratings without receiving an equally favorable review, because these ratings are only part of the criteria used to determine a package's overall effectiveness.

PRESENTATION GRAPHICS

Suitability to Task



The Tasks

The **easy chart** is a simple column graph created using imported spreadsheet data; it has a title and a piece of clip art added to it.

The **complex graph** features overlapping three-dimensional columns created using imported spreadsheet data, with a diagram drawn using freehand drawing tools and an imported scanned graphic added to it. The process of modifying the graph calls upon the advanced color, fill, and graphing features of the program.

The **word chart** consists of a bulleted list created using different fonts with drop shadows. The task requires the reviewer to attempt to spell-check the chart.

The **repetitive charts** are three similar word charts created using a style sheet or template of the first word chart if possible. To score highly, the package must be able to replicate charts quickly and easily.

The **desktop presentation** is an electronic slide show of all the previously created images displayed on the reviewer's monitor. Ideally, the reviewer should be able to add transitional effects between slides and to control the amount of time each image is displayed. Easy sequence reordering and manual display are also important.

The **desktop publishing** task was created because many users export images created in presentation graphics programs to other applications. The reviewers were asked to export the complex graphic to a desktop publishing program and/or perform a black-and-white conversion for output to a laser printer.

The Ratings

4 = Excellent. The software offers all the required features and can perform all the elements of the task with ease.

3 = Good. The software offers most of the required features or performs the task well but requires extra work to do so.

2 = Adequate. The software is able to perform the task but either lacks some key features or is cumbersome to use.

1 = Poor. The software is able to perform the task but lacks so many features or does it so awkwardly that you really wouldn't want to use it.

0 = Unacceptable. The software cannot perform the task.

printer, the computer screen, or a Slide Service Bureau;

- **import** from or export to at least four different data (.WK*, ASCII, .DBF, .DIF, .XLS) and graphics (.CGM, .TIF, .EPS, .PCX, .XLC, .WMF, .DRW, .IMG, .PIC) file formats;
- **create** the basic chart types, including column, pie, bar, line, scatter, and word charts;
- **draw** basic graphics primitives besides offering ready-made clip art;
- **present** an on-screen slide show (also called a desktop or electronic presentation), organize elements into a presentation, and help create adjunct materials such as speakers' notes and handouts;
- **support** VGA to optimize true on-screen color and resolution.

MAN OR MOUSE?

Nothing in the above criteria precludes these programs from providing their functionality in a text-based interface. In fact, most of them (*Freelance, Graphics Gallery, Harvard, Kinetic,* and *SlideWrite Plus*) still use the design-by-forms approach, which all the early business graphics programs once had. When you create a chart using these packages, you are guided through the process textually. You describe the characteristics of a graph by filling in the blanks in an on-screen checklist: What kind of graph? What interval to use for axis scaling? Which pie slice to explode? 3-D effect? Legend placement? Drop shadows?

Devotees of this "design-by-forms" approach believe that nonartists work best describing visuals in literary terms; they say charts and graphs are created faster when you're not directly manipulating them. This idea holds up fairly well until you delve into the realm of drawing capabilities. All of the text-based programs separate their drawing-and-annotating modules from the rest of the program. And while, like *Windows*-based *Graph Plus* and *Xerox Presents,* they all support alternate input devices (all of these programs support both Microsoft and Logitech mice and some type of digitizer or tablet), you cannot use such devices in the drawing modules without doing some key pressing. Compared with their counterparts in packages based on a graphical user interface, the drawing modules in text-based packages are cumbersome. You just can't use

PRETTY, BUT DUMB?

by Robert Johnson

Everyone following the development of presentation graphics software during the last few years knows that application developers have been working overtime. Like a fine-tuned assembly plant, they have churned out new model after new model with feature upon feature upon feature.

I say it's time they took a short break.

While developers deserve commendations for the fantastic capabilities they have built into today's graphics offerings, they need to apply their talents in another area. Future versions of graphics packages need to offer built-in intelligence—expertise in the graphics process—and the flexibility to let you customize them according to your requirements. The result will be applications that improve the quality of graphics output across all skill levels—a goal that is of supreme value to corporate users and their management.

Intelligently designed software makes decisions for the user, who can then choose to override the recommendations or actions resulting from these decisions. The effect of this is to automate processes and tailor options, features, and actions to particular tasks, audiences, and situations in a transparent way. Such intelligence can be provided by knowledge-based front ends, intelligent defaults, and information that is embedded into the body of a program. Intelligent software develops a list of considerations or rules that are particular to the needs of individual users.

One of the benefits of such built-in intelligence would be to reduce the amount of time it takes to create a presentation. Most people create presentation materials under time constraints. They want programs that will speed up the process and ensure high quality, not make presentation preparation a major event. Speaker's notes, handouts, a separate screen for the presenter, and visuals with graduated backgrounds are all nice in theory, but that theory is impractical when you think of the time crunch of presentation creation versus the time drain caused by these additional capabilities.

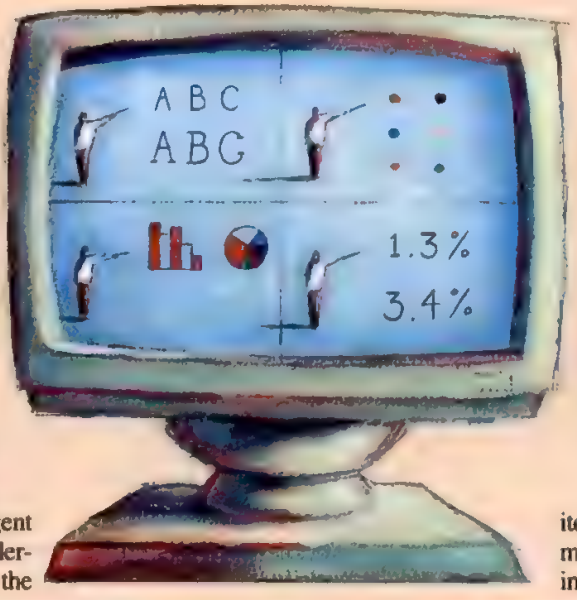


ILLUSTRATION: STEVE DINNINO

Many casual users, especially those who work with programs on a sporadic basis, have not even mastered the capabilities of most of the programs they use. Unfortunately, many software developers don't recognize this. Competitive pressures and requests from power users lead to packages offering technically superior features that are worthless to all but a few select users. The vast majority of people haven't reached their current version's limits.

If you ask a desktop presentation software company how long it took to create the impressive presentation promoting their program—including an on-screen show or slides, handouts, and speaker's notes—the honest answer will be a considerable amount of time. Your equally splashy presentation will take an equally long time to prepare. And is that splash vital? Isn't the real need to quickly graph data and make the presentation look clear, concise, and effective?

The user community needs software programs with more intelligence built in to them, not more features. Enough, then, of the lets-add-feature-upon-feature mentality prevalent today. Few people have the abilities of a graphic artist, who knows which of 256,000 colors should be combined for use in a bar chart, nor do most people understand that the maximum number of colors used in a chart should be limited to five. Instead of just giving more options and more ways for the inexperienced user to mess up an im-

them as effortlessly and comfortably.

These drawing difficulties create problems in an era when the unannotated graph is considered hardly worth showing. As a look at *USA Today*—or any other bastion of quick-fix visuals—will tell you, effective graphics are not subtle. They clobber you over the head. You can annotate your graph and make it memorable in any number of ways. Sometimes this means adding a telltale icon, sometimes an eye-catching blurb in a box, sometimes arrows and text, but the solution always calls on the drawing features of a graphics package.

Luckily, all of the drawing modules of these programs contain clip-art libraries, most of which have recently been beefed up. Instead of creating your annotations from scratch, you can comb through these files of ready-made art in the hope of finding something you can use. Letting the user modify the clip art by breaking it into its components is always a plus—a feature that separates the powerhouses from the punier programs.

Typically, clip-art libraries are chockfull of business and industry icons. Some of the better collections include borders and backgrounds. Libraries vary in the number and sophistication of their images. *Graph Plus* offers a sizable library of simple images; *Xerox Presents* has a smaller library, with images more fully rendered. (Add-on clip-art libraries for *Harvard*, *Graph Plus*, and *Freelance* are reviewed in the feature "PC-Based Clip Art: Instant Images" in this issue).

THE DATA QUESTION

The most debilitating aspect of early graphics programs was that you had to rekey spreadsheet data into the graphics pro-

age, developers should provide ways to guarantee that the chart is as visually effective as possible.

Embedded intelligence in graphics programs will remove unnecessary options, customize features and menus to meet particular user needs, make decisions that speed up the image-creation process, and ensure that certain rules for effective visuals are followed.

In the presentation graphics area alone, decisions that can be built in to programs are everywhere. A program might:

- Recommend a chart type depending on the nature of the data. Since most data is imported from spreadsheets, why can't graphics programs read the data and suggest a chart type based on the format and number of data points? For example, if the format is percentage and the number of points that add up to 100 percent is six or fewer, recommend a pie chart.
- Have the user identify the audience type and recommend appropriate font styles for presentation text. If the audience consists of accountants, a font style frequently used for annual reports might be recommended.
- Have the user pick out colors close to or matching their corporate colors during program installation. Use those corporate colors to create a library of custom color combinations where they are used for the background and other appropriate aspects of images.
- Provide intelligent spreadsheet links for ongoing presentations. These links would update charts automatically by referencing a new cell location each month or period. Often subsequent data is input in the cell immediately below or to the right of the current cell. "Teach" the program to recognize this pattern through a simple series of questions when the chart/spreadsheet link is initially set up. The program can use the computer's internal clock to find out the date on which the updated information is to be input into the spreadsheet. The chart can be automatically updated on or after that target date whenever the program is started. In addition, give the program the intelligence to update chart headings automatically to reflect the time-period change.
- Provide a knowledge-based application front end that will modify a presentation based on audience considerations. A work screen will allow the user to type in appropriate information about the individual(s) viewing the presentation, to choose a system configuration that the audience will be interested in, and to identify the aspects of the presentation that are expected to be "hot buttons." The knowledge-based front end can then reorganize and customize the sequence and the individual images with those criteria in mind and create a presentation that is tailored automatically with a minimum of effort.

Corporations want to know that their standard products will increase efficiency and productivity, maintain a high level of quality, and enhance the corporate image. By building in the intelligence of typographers, graphic artists, and statisticians, rather than building in more features, presentation graphics application developers can help meet this need. ■

gram in order to generate a graph. Today any half-wit graphics program imports from ASCII and *Lotus 1-2-3* files. Old diehards still import .DIF files, and forward thinkers work with *Excel* data files.

For chronic data users, a dedicated link from spreadsheet to graph is essential. *Freelance* and *Harvard* both have automatic data links to let you mate a data worksheet with a graphics template. When you update the data, the graph is updated automatically. *Graph Plus* gives you a king-size spreadsheet and lets you block ranges of data from graphing, letting you create multiple graphs from a single data source.

If you're a scientist or engineer, you may appreciate these live links, but you'll probably also want features such as logarithmic axes, error bars, and curve fitting. Within this group of packages, you're most likely to find such features in *SlideWrite Plus*, but you may also consider the dedicated scientific graphing products reviewed in the March 14, 1989, issue. Their output may not be as pretty—they're best at creating simple graphs—but their approach is much more data-intensive.

NO PROGRAM AN ISLAND

Graphics programs are the quintessential middlemen. Getting the data in is only half of the equation. A graphic must be spewed out in a usable fashion. This means exporting to a TIFF, .EPS, or .PCX file to include a graphic in a word-processed or desktop-published document. It means exporting to .CGM or SCDL format for slide imaging.

Drawing programs (see the June 27, 1989, issue) and third-party clip art (reviewed elsewhere in this issue) validate the demand for the ability to import various graphics formats. A stunning diagram created outside of your presentation program should be able to find its way into the show. Scanned and video-captured file formats should be importable.

The safest recourse is a hands-on field test of your potential import/export connections. Many programs' claimed import capabilities are often rife with problems. *Freelance*, for example, can import a TIFF file, but you won't see the image displayed on-screen. *SlideWrite* doesn't really import, it merely references the file, so you can never get rid of the original file. *Harvard* will import an .EPS file but does not display the attached bitmap on-screen; you see a gray box. Most of the programs can size an imported image; few can colorize one.

WYSIWYGMOL

There was a time when WYSIWYG was something you either had or didn't have. Now it's measured in degrees, and the culprits of the confusion are typically fonts and color. Early graphics programs couldn't show you how your final graphic would look as output. You often got a crude stick-figure approximation of the space the text fonts would occupy and a paltry four colors on-screen. Sixteen colors is the bare minimum these days (though some, like *Freelance*, use only 13). *Graph Plus* and *Xerox Presents* can display 256 true colors from a palette of 16.7 million.

Depending on your output device, WYSIWYG is usually WYSIWYGMOL (what you see is what you get, more or less), often because screen fonts and device fonts are unmatched. Some products, such as *Kinetic*, limit and simplify the options by building a few fonts right into the program. The most highly evolved programs will support fonts from a number of places: built into the software, built into your device, and downloadable to your de-

vice (as Bitstream fonts are).

The more sophisticated font handlers offer the best results and the worst headaches. For example, *Xerox Presents* supports Bitstream fonts, and you can use the Bitstream outline fonts to create the precise fonts you'll need, in the sizes and for the devices you need them. But Xerox's slide service does not support the Bitstream fonts, nor even approximate them. Suddenly you find yourself creating device-dependent images—which is a real nuisance.

SLIP SLIDING AWAY

As the output illustrations for these packages attest, the largest discrepancies between what you see on-screen and what you end up with as output occur when the output in question is a slide. Slides are the leading form of output for business presentations. Thanks to desktop film recorders and service bureaus, it is possible, for a modest investment, to create a glamorous slide production.

Service bureaus may be the great equalizers in the presentation field. You don't need a $25,000 dedicated film recorder and a full-time babysitter/technician to get quality slides. All you need is a graphics program that supports a slide-making device, about $10 per slide, and, unfortunately, the patience of a saint. My rule of thumb is that slide-service bureaus work fine unless you're in a deadline situation (which for most people is almost always the case).

Our experiences with slide bureaus during this project taught us that we were dealing with a less-than-perfect link. Some of the reviewers found out that a service bureau had mapped their colors incorrectly, some lost font attributes, some sent files that the receiver could not read, and some had their titles and legends truncated. Even when all the elements were in place, the sizing and layout of the slide never looked quite as it did on the computer screen. Ultimately, all of the reviewers produced slides to be proud of, but it required a few practice runs.

WHAT AND WHEN

Slides are often the desired end product for users of presentation graphics software, but not always. A good presenter knows which medium to use and when it's appropriate to use it. A tutorial session might require overhead transparencies printed with the aid of a color printer or plotter. Printed reports demand black-and-white (or gray-scale) printer output. Since each device has its own ground rules, designing with output in mind becomes crucial. When a package is touted as being able to output to six different devices, take heed. You'll be the one who does the optimization for each device.

The best programs sport automatic conversion to black and white. For some packages this means a simple black-and-white line conversion; for others it means a conversion using crosshatched pattern fills (the op-art effect). Optimally it means gray-scale support. But no matter how good the conversion, you'll always have to go in and tweak.

Device optimization is only one area where presentation graphics programs could benefit from an added measure of intelligence. With basic functionality under control, vendors should begin to design intelligent front ends that help create better-looking, more-informative charts in spite of ourselves (see the sidebar "Pretty, but Dumb?").

Service bureaus may be the great equalizers in the presentation field. All you need is a graphics program that supports a slide-making device and, unfortunately, the patience of a saint.

ALSO IN THE RUNNING

We'd be remiss not to mention at least some of the hundred-odd other presentation graphics programs that are out there. The group of programs we're reviewing are the cream of the crop. But they're large both in terms of the number of features they offer and the amount of RAM they devour. They also have steep learning curves and hefty price tags ($495 to $499 for every package except *SlideWrite Plus*, which is $445). To top it all off, these programs may offer more than you really need.

There's an entire clan of leaner and meaner presentation graphics programs that tend to do one thing well. *Graph-in-the-Box* doesn't produce fancy 35mm slides, but it's easy to use and it waits in RAM until you get the urge to create a visual. *Graphwriter II*, from Lotus Development, is the king of automated charting. General Parametric's *VideoShow* is a hardware/software solution found in many a boardroom. Communication Dynamics' *Image Builder*, the $99 wonder, excels at text slides with drop-in clip-art images but can't produce anything beyond "proof-quality" hard copy. A soon-to-be-launched product from Brilliant Images Slide Service, *Words to Images*, will let you use your word processor to bang out 35mm text charts and ship them to a slide bureau.

Taking its lead from the desktop publishing industry, a new genre of lightweight software for the casual user is also being promoted. Software Publishing Corp.'s *PFS:First Graphics* is literally a *Harvard* for juniors, with a subset of its big brother's functionality. Spinnaker Software introduced *PinStripe Presenter* for $199, a solid program for producing visuals but without the import/export capabilities of the big-leaguers. *Freelance Plus* is also destined to be released in a new diet-sized package for those whose demands are less rigorous. Finally, Symsoft's *Hotshot Presents* is a newcomer that uses a bi-directional text outliner as the backbone for a presentation (see First Looks, August 1989).

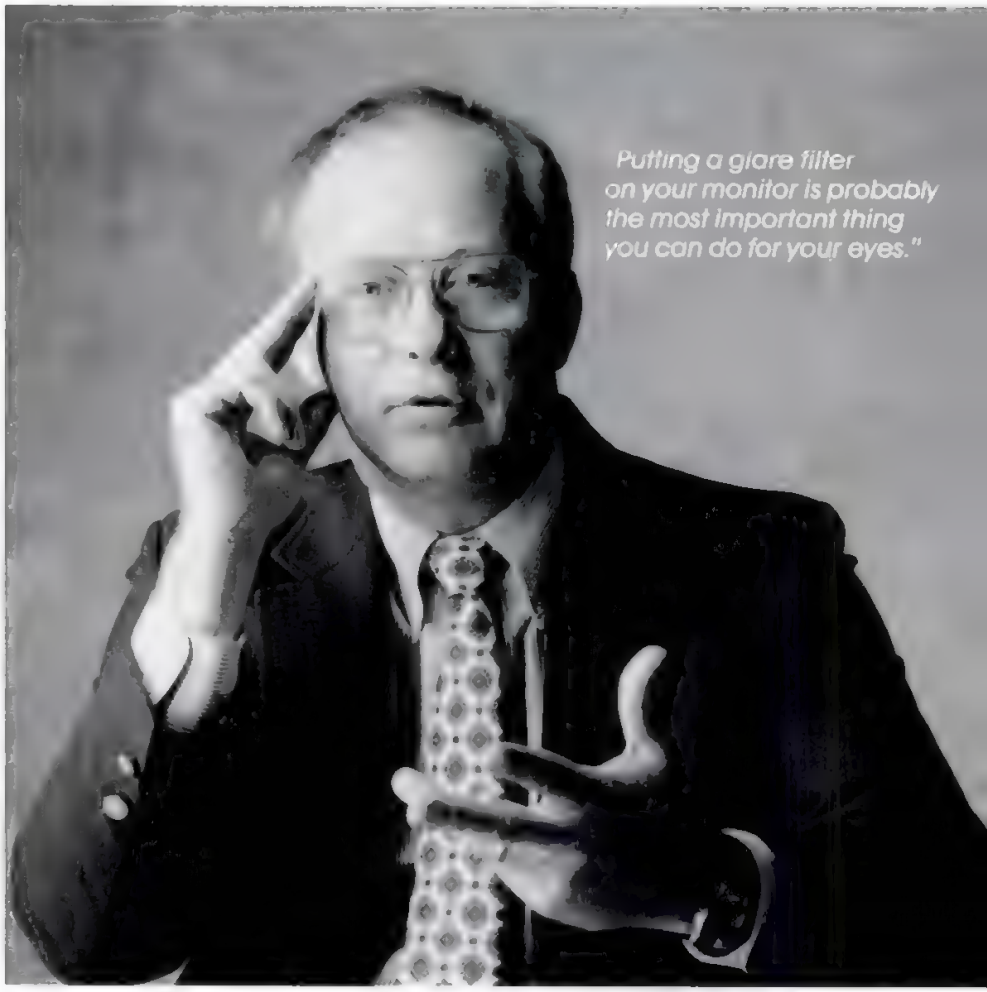
JACK-OF-ALL-TRADES

If you've read this far into the article, however, you probably know that these "junior" products aren't for you. You want a presentation graphics package that does it all, a certifiable jack-of-all-trades. Sadly, the vast majority of jacks-of-all-trades are masters of none, and the packages in this group are no exception. All of them have their strong points, but none is superb overall.

For now, the best counsel we can offer you is to determine what your main presentation/creation needs are and choose accordingly. But we remain optimistic that among the many new products and upgrades currently in the works—including a new version of *Harvard* and PC versions of *PowerPoint* and *Persuasion*—one will soon emerge that more closely approaches the ideal.

"Since I began using a computer five years ago, my eyeglass prescription has increased three times."

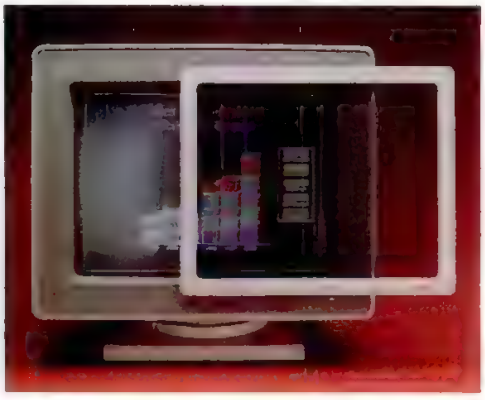
Tom Judd, president and founder of Curtis Manufacturing, on why you should use a glare filter.



"Headaches, blurry vision, scratchy and burning eyes, overall visual fatigue ... These are the most common manifestations of monitor glare.
The solution? Get a glare filter.
The Curtis Anti Glare Glass Filter has been specifically designed to reduce monitor glare and improve on-screen contrast. Using one reduces headaches, visual fatigue, and even neck and back strain.
When I asked our design team to develop the highest quality, best value glare filter on the market, I learned that certain filter elements worked better than others:"

Glass vs. plastic:
"When I tested the plastic models, they scratched so easily after one cleaning, I could see for myself that glass was significantly better."

Glass vs. mesh:
"I have a high resolution color monitor. When I put a mesh filter on it, the monitor was harder to read, not easier. The mesh made the characters appear fuzzy."



Two-sided optical coating vs. one:
"I learned that monitor glare would hit both sides of the filter. A glass filter with optical coating on both sides visibly reduces glare better."

Cleaning the filter:
"All glare filters need to be cleaned occasionally. I asked, 'How?' Our design team answered by including a bottle of specially formulated, non-streaking cleaner and a lint-free cloth in every package. No other manufacturer does this."

Reversible frame:
"I asked for a durable, cosmetically attractive and ergonomically designed frame. Our designers delivered with a unique high-impact injection molded plastic frame which is black on one side—for those who want the utmost ergonomic design—and gray on the other side—for those who want to match the aesthetics of their monitor."

The results:
"The technical specifications of our filters are impressive: glare reduced by 95%, contrast improved 20 times. The design team told me how successful our product was, but I didn't realize it until I put one on my computer. What a difference! In fact, the Curtis Anti-Glare Glass Filter worked so well, I had one added to every computer at our corporate headquarters."

If you'd like to know more about the Curtis Anti-Glare Glass Filter and other Curtis products that make life in front of a computer easier and less stressful, write or call for our free brochure: *Tips to Computing More Comfortably.* Curtis Manufacturing Company, Inc., 30 Fitzgerald Drive, Jaffrey, NH 03452. (603) 532-4123 ext. 871

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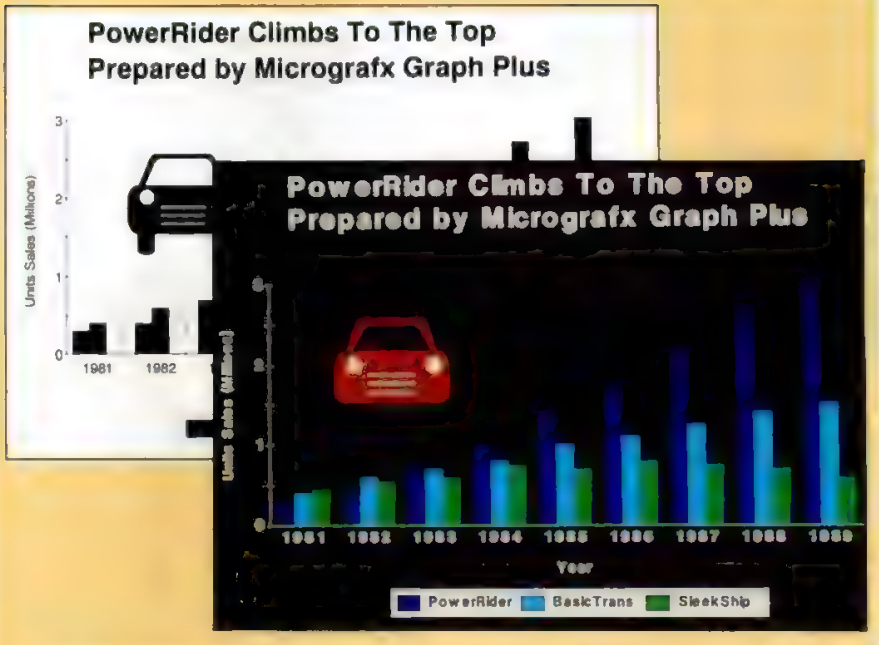
Graph Plus

by Robin Raskin

Don't let its name fool you. *Graph Plus* is a marvel when it comes to graphing data, but the $495 program is no slouch when it tackles the larger realm of presentation graphics, with the notable exception of word charts. The program from Micrografx earned industry accolades as a versatile charting and drawing program (it was a *PC Magazine* Best of 1988 selection), and the new Version 1.3 puts even more oomph into the *Plus* in *Graph Plus*.

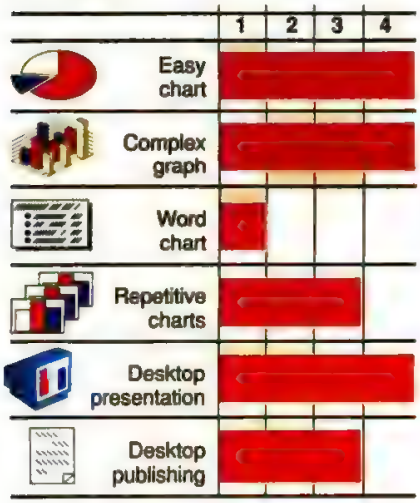
Graph Plus is the only graphing package that seamlessly integrates its drawing and charting features. The drawing module is just another pull-down menu on the well-implemented *Windows* main menu command line. All of the graphics primitives are menu-selectable, including some esoteric shapes such as parabolas and rounded rectangles. A curve-smoothing



Graph Plus's heartbeat is its king-size, spreadsheet-style worksheet. It has simple math capabilities built into it, and any highlighted range can be graphed in a variety of formats. The $495 *Windows*-based package's drawing and annotation facilities are among the best of this group.

GRAPH PLUS

Suitability to Task



feature works wonders with freehand drawing. The block-select editing tool makes it easy to group elements for editing. This facile integration of charting and drawing can be appreciated by anyone who thinks of drawing and annotating as integral to the graphing process.

Besides being well integrated, this package from Texas does just about everything a bit bigger and better. Most data worksheets in graphics programs are stunted; the one in this package is a full 256 rows by 16,384 columns. Most programs offer a few possible line widths; *Graph Plus* offers variable line widths to .01 inch. Most let you zoom in on a region; this one lets you zoom as deep as a 1- by 1-inch area. Most programs let you work one screen at a time; *Graph Plus*'s work area can be 12 8.5- by 11-inch pages, which helps insure consistency among images and makes for easy interframe cutting and pasting. Forty different pattern fills, 16.7 million colors available on-screen with three color-mixing techniques . . . the impressive list could fill a Stetson hat. One area in which largeness is a negative for *Graph Plus* is in the size of the program itself—it takes up a full 640K and doesn't support LIM 4.0.

The major chart types supported are bar, line, area, scatter, pie, column, mixed, and table, but each of these has submenus to create endless variations on the theme. For example, an area chart can be smoothed or jagged, stepped or cumulative. Options with their own pop-up dialog boxes provide fine-tune control. For example, the Progression option not only lets you create a 3-D effect, but lets you control the direction of the 3-D projection, the view angle, the amount of depth perspective, the degree of separation between a column or bar, and other elements. The "tweakability" factor is high.

The full-size spreadsheet is also flexible. You can create any number of graphs from one worksheet by marking a particular range of data. This technique will be in-

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CIRCLE 306 ON READER SERVICE CARD

MACLUST

by Robin Raskin

Presentation creation usually entails jotting down some notes, organizing them into a sensible hierarchy, and then adding some supporting visuals. Most of that work is text- rather than graphics-related. In fact, it is estimated that most presentations are about 80 percent text. How ironic that this *verbal* nature of presentations was best understood by those graphical Macintosh developers.

While PC-based efforts to create presentation graphics software have historically focused on how to make a fundamentally text-oriented machine generate decent pictures, the Mac folks were charting a different course. Because the Mac has a standard graphical interface, Mac developers could afford to spend their time thinking about the elements of presentations.

Microsoft's *PowerPoint*, Cricket Software's trio of *Draw*, *Graph*, and *Presents* (two of which have been ported over to the PC under the auspices of Xerox), and Symantec's *More II* all offer impressive features addressing the presentation as a whole. But it is Aldus's *Persuasion* that is clearly the Mac's state-of-the-art presentation program at present. To illustrate what makes the Mac-based presentation graphics so great (and so different from what we've got on the PC), we've compiled a list of some of its more-salient features:

- *Persuasion* stresses content, thanks to the bidirectional outliner at its core. After you've named your presentation, you're confronted by a blank text outliner. You are forced to use the outliner to gather your thoughts—to determine what you want to say and when you need to say it. When you're finished with the outliner, you know what your presentation needs to contain; you need create only the visuals you require to get your point across. (With PC-based programs, you create your presentation in the opposite order: first you draw or graph each element individually, then you organize the individual elements into a show.)
- *Persuasion* fits content to a form through templates that let you pick a single set of parameters and apply them to all your images in one fell swoop. Each *Persuasion* template contains the global attributes—typeface, alignment, positioning of graphic elements, color scheme, and so on—for a group of master slide designs (including title slides and text slides). Using these templates, the show takes on a uniform appearance almost without effort. (With most PC package templates, you pick a design and apply it to a particular bar chart or a text chart, but not to all different kinds of charts at once.)
- *Persuasion*'s drawing tools are contained in a graphical toolbox. Once a shape (such as an ellipse or rectangle) is drawn, its attributes (such as its line width and whether or not it needs to be filled) can be specified. *Persuasion*-drawn items are easy to manipulate, and the program contains special effects, such as rotations, arcs, and graduated fills, which are not found in most PC programs.
- *Persuasion* has powerful text-editing tools, including a built-in search-and-replace function that lets you ferret out text located anywhere in your presentation, as well as a spell checker. The text editor also lets you assign text attributes such as font, size, bullet, style, color, and alignment to chunks of text through simple pull-down menus.
- *Persuasion*'s slide-show facility includes an "on-screen builds" feature that allows you to create an image in layers, building one on top of the next.
- *Persuasion* automatically creates supporting tools like speaker's notes and audience handouts. A note template with a reduced version of your image and a place for you to enter text is provided. If you change an element in your show, the change is reflected automatically in the corresponding speaker's note. (Most PC packages can create acceptable-looking support materials, but not nearly as easily.)
- *Persuasion* lets you organize your presentation elements graphically by displaying them as a series of thumbnail images that you organize with a mouse by clicking and dragging each to desired locations. (*Xerox Presents* is the only PC-based package to offer this feature.)

The one area where PC-based programs have equal footing with—if not a bit of an advantage over—*Persuasion* and the other Mac-based packages is graphing. *Persuasion* cannot create a dynamic link to an outside spreadsheet the way *Harvard Graphics* and *Lotus Freelance Plus* can. It does have its own internal data sheet, which can be used to import or enter data that can be graphed according to a variety of predefined chart formats, and *Persuasion*'s graphical user interface makes it easy to fine-tune chart elements such as axes, legends, fills, labels, and arrows.

If all that *Persuasion* has to offer sounds appealing to you, take note—PC-based versions of Aldus's presentation program, as well as one of Microsoft's *PowerPoint*, are expected to be available on the PC this fall. For *Persuasion*, the prognosis for a smooth PC implementation is excellent. Aldus has a proven track record for writing good code that works on both PC and Mac platforms. (Almost 80 percent of the code for Aldus's *PageMaker* is shared by both the PC and the Mac versions.) Unlike the Cricket/Xerox duo, where the PC implementation was an afterthought, a PC version of *Persuasion* was undoubtedly on the drawing board from its inception. ■

valuable to you when creating multiple charts, combination charts, or charts with linked data. Scientific charting is fairly strong with the inclusion of semi-log and log-log charts, regression analysis, and the ability to overlay charts on-screen. One important omission in the scientific realm is error-bar charting.

Those doggedly determined for real-time data acquisition can take advantage of *Graph Plus*'s DDE (Dynamic Data Exchange) for linking *Microsoft Excel* data to graphics, although Micrografx has not enjoyed much success using DDE.

HYPERHELP

Version 1.3 adds many features without sacrificing the ergonomic design. To begin with, there's now an on-screen help that's so good, you might call it hyperhelp. The indexed help is broken down into subcategories, and the context-sensitive help lets

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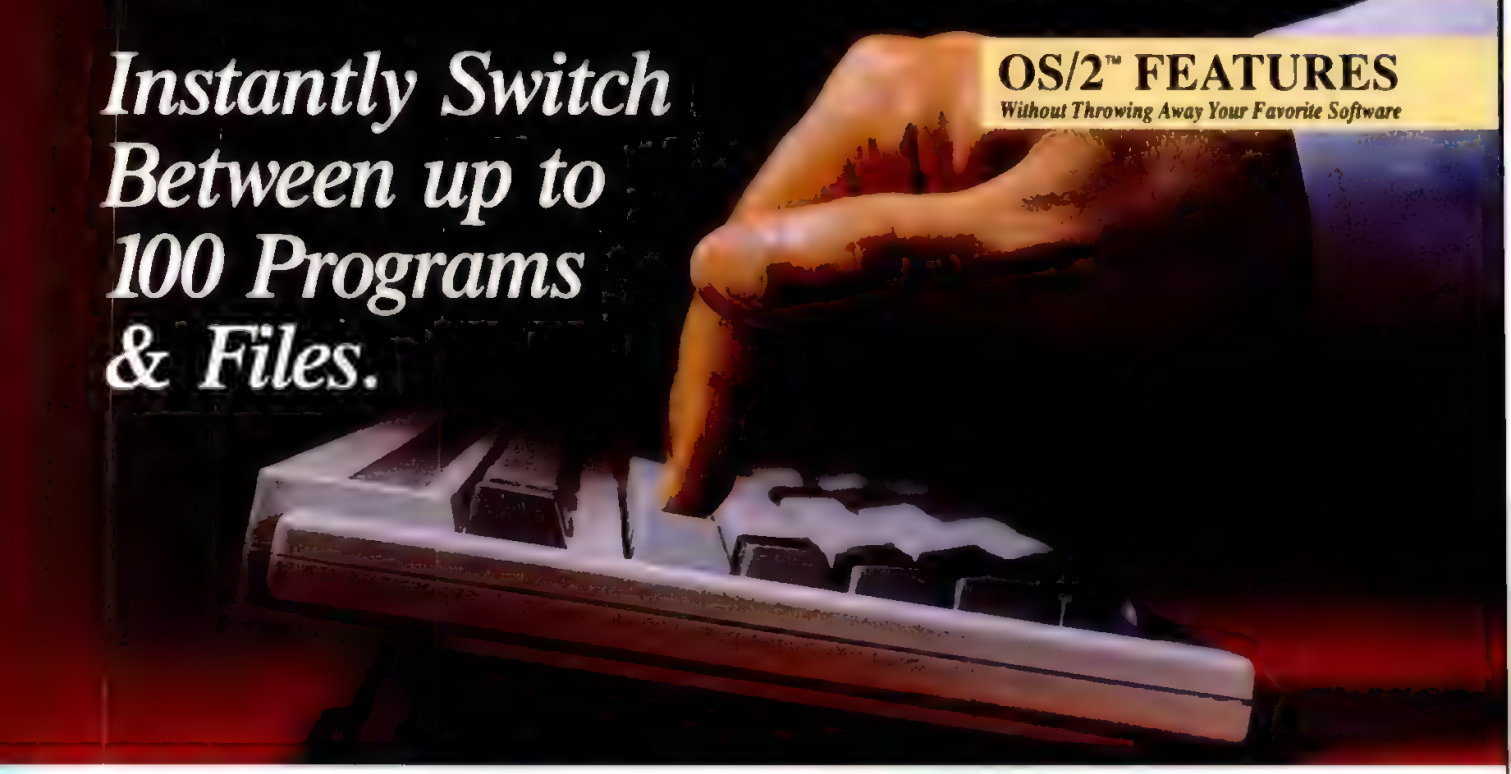

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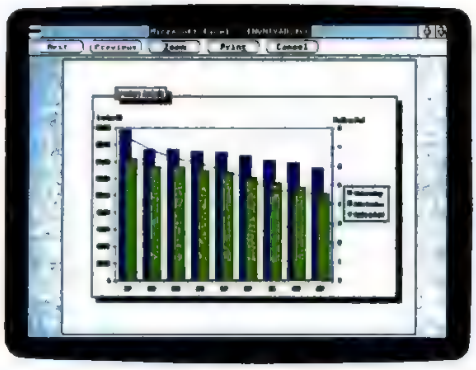
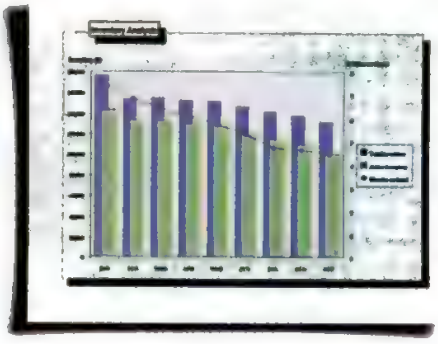
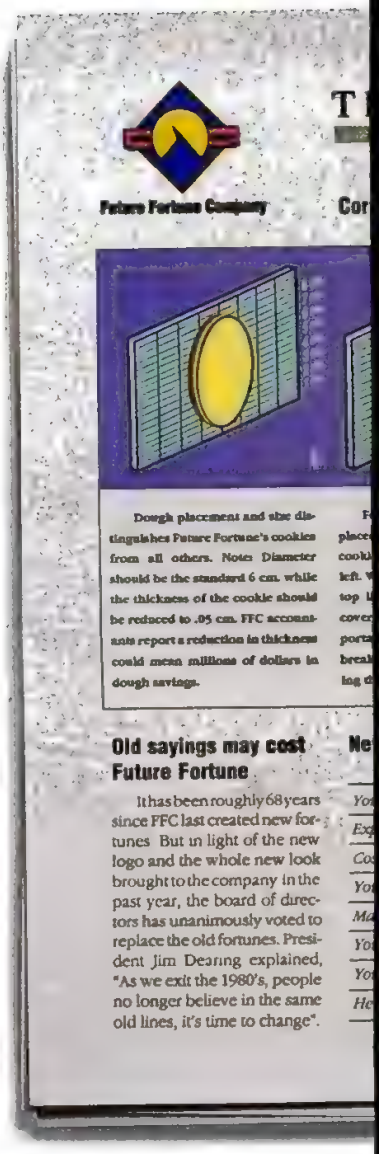


WYSIWYG. What you see on screen...



...is exactly what you get on paper.



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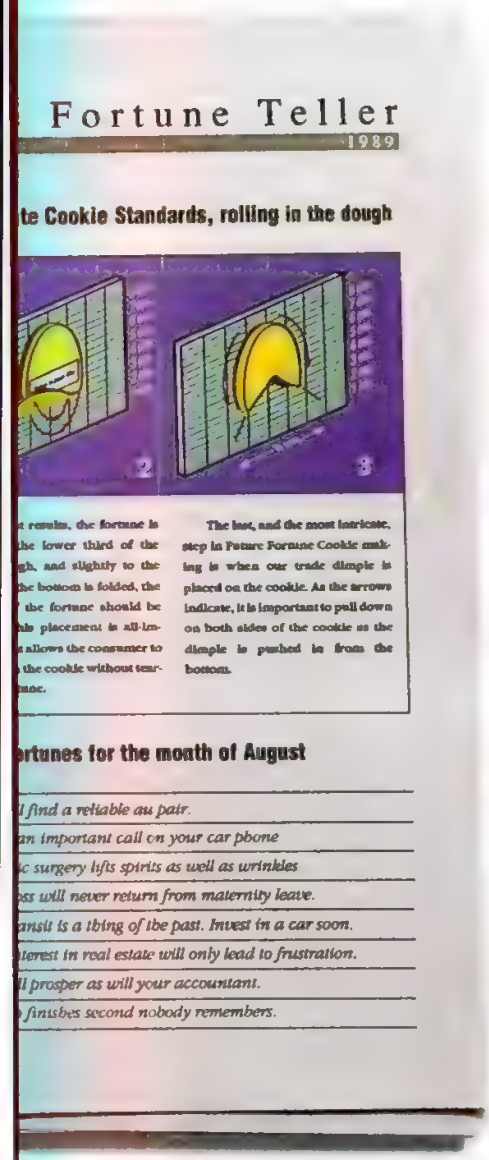

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you move forward and back, and even open multiple windows.

Micrografx has garnered a reputation for stellar graphics translations. The new import and export facilities of *Graph Plus* are a subset of Micrografx's soon-to-be-announced wunderkind graphics translation program. The list of files you can maneuver—.TIF, .CGM, .EPS, .DXF, .PCX, .WMF, and so on—reads like a who's who of extensions.

FACT FILE

***Graph Plus*, Version 1.3**
Micrografx, 1303 Arapaho, Richardson, TX 75081; (214) 234-1769, (800) 272-3729.
List Price: $495 (upgrade to version 1.3, $49).
Requires: 512K RAM (640K recommended), DOS 3.0 or later. Hard disk and mouse recommended.
In Short: A seamlessly integrated drawing and charting package that shines in both categories and takes full advantage of the *Windows* environment. This newest release adds a slide-show facility, impressive file-translation routines, and vector clipping. Not especially strong on word charts.

CIRCLE 397 ON READER SERVICE CARD

Another new feature, vector clipping, addresses plotter (and some film recorder) users. Vector clipping eliminates the problems that occur when background objects bleed through in an overlay drawing. It's a feature usually reserved for CAD packages.

But the big news for the presentation crowd is *Graph Plus*'s new slide-show feature. Because you can use .PIC, .GRF, .DRW, .PCX, or .TIF files in a show, the elements of your show can come from many applications. Once you select the slides you want included in your script via a dialog box (the selected slides appear as a series of thumbnails), you specify timing and performance effects.

Special transitional effects are divided into two global categories: fades and wipes. A fade can be controlled in terms of its coarseness or fineness. A wipe can include 14 directional effects that can have your graphics flying in and out from all corners of the screen. Some special effects such as weaves and rains are not supported, but, in fact, these are often dangerous in the hands of untrained users. Another missing link is a runtime version facility, although since the slide show is a separate utility, you can run a slide show on any machine that has *Windows*, provided you copy the utility and respective files to a floppy disk.

The Micrografx folks are certifiable *Windows* mavens. Few support the environment with the same gusto. They've made the program feel fluid by incorporating an interruptible screen redraw. As the screen redraws, you can go ahead and select the next menu item. They've also created some of the most robust *Windows* device drivers (which work with any *Windows* application). Drivers like the ones created for the Matrix camera and the HP PaintJet are really miniapplications with their own pull-down menus for specifying attributes.

ACHILLES' HEEL

But even Texans have an Achilles' heel. The weakness is word charts. There's no drop-shadow text, no bullets, and no interline spacing. There are no templates for word charts and no text justification. We managed to create the drop-shadow text for our word slides by copying the text and offsetting it. At best a primitive technique.

Some of the program's flexibility can be intimidating, especially when you've got to work with nonvisual choices. For example, you need to be a fraction whiz to choose between line thicknesses in 64ths and 100ths of inches—An interactive sample box would be much better. The documentation is passable, not outstanding. Version 1.3 adds a slim supplement to the existing user manual. Installation is no problem, and a runtime version of *Windows* is included for those who don't own *Windows*.

No review of *Graph Plus* would be complete without mentioning its extended family. *Micrografx Designer* is a spunky $695 illustration program that can be used to create complex bezier-curve-based drawings (see "Fine Lines: The PC as Illustrator," *PC Magazine*, June 27, 1989, where it was awarded Editor's Choice). *Graph Plus* creations can be whisked into *Designer* for the ultimate in designer graphs. *Graph Plus*'s clip-art library is a utilitarian 500-image subset of Micrografx's gargantuan libraries of *Designer*-created clip art (see "PC-Based Clip Art: Instant Images" in this issue for a complete review). Twenty-five additional specialized clip-art libraries are also available from Micrografx for $79.95 a piece.

Graph Plus is an excellent choice for presentation-minded graphers, thanks to its superb data-handling and drawing capabilities. The only reason you wouldn't want to use it is if your main need for a presentation graphics program is to create word charts.

The Graphics Gallery Collection

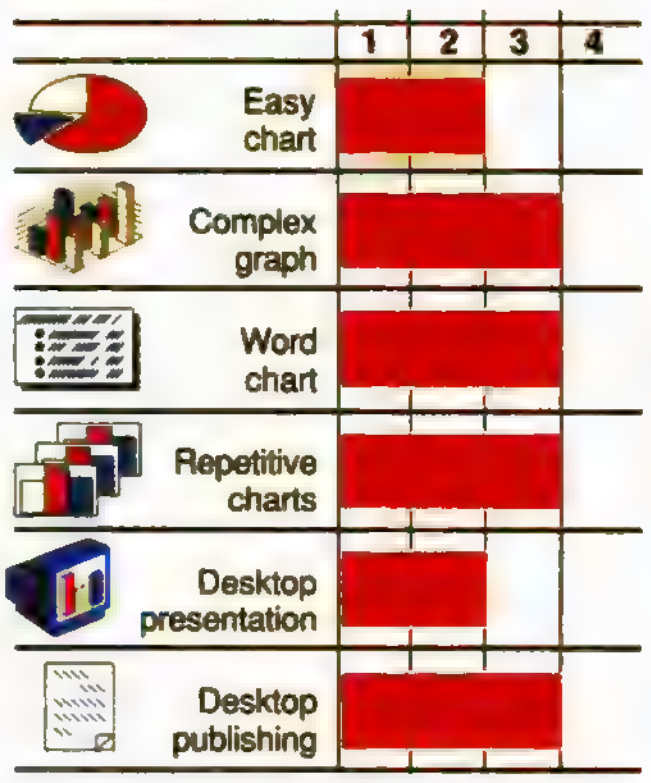
by Alfred Poor

Capable of producing some excellent business graphics, Hewlett-Packard's $499 *Graphics Gallery Collection* has flaws that can make it difficult to achieve the results you seek. Most of these problems are related to the incompleteness of integration between the program's two modules.

The two separate programs are the Drawing Gallery and the Charting Gallery. If you are creating a graph, you create it in the Charting section, store it as a picture, then run the Drawing program to edit and add to the image.

The Charting Gallery has plenty of standard forms from which to choose,

THE GRAPHICS GALLERY COLLECTION
Suitability to Task



such as pies with exploded pieces and 3-D bar charts. The 3-D options on the pie charts are effective, but the depth on bar charts is barely noticeable.

In the Charting module, you have little choice about the placement of text elements but you can make a number of choices about fonts. You can also color the

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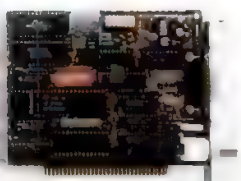

G/Ethernet 8-bit PC adapter

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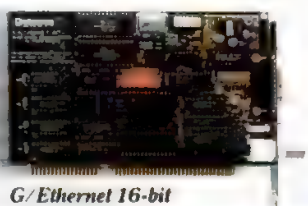

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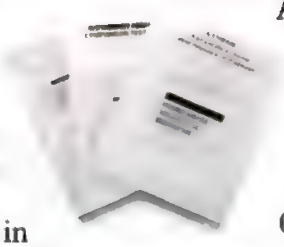

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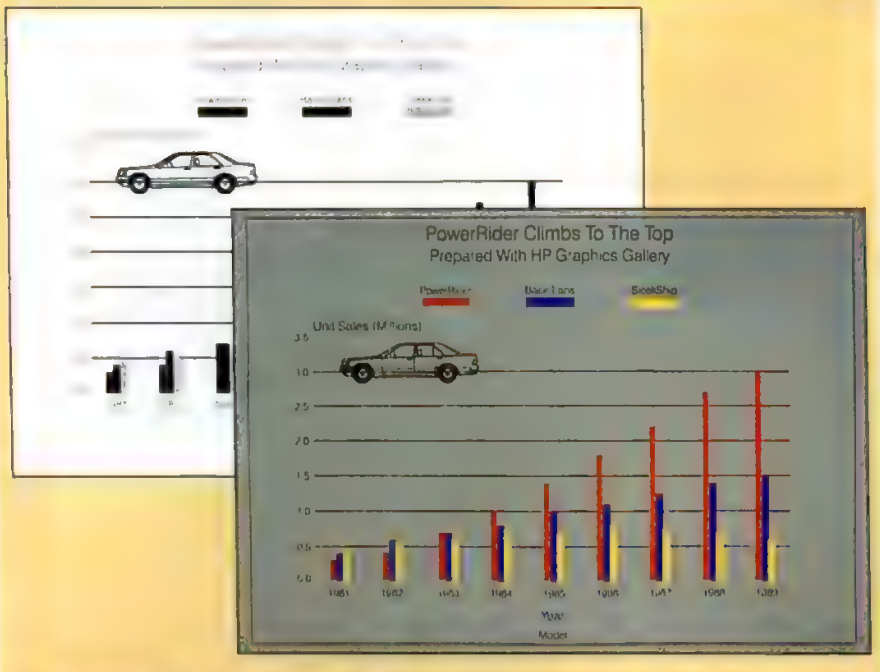

The Graphics Gallery Collection has two separate modules; most of the creative work is done with the Drawing Gallery module. The object orientation of the $499 program's draw module makes it easy to manipulate graph objects, but the two modules don't work as well together as they should.

parts of your charts, and the program will do an excellent job of replacing the colors with gray-scale shading if you choose to print the images with a black-and-white printer, such as a laser printer.

When you move an image over to the Drawing module, you find that things are more flexible. To start with, pictures are object-oriented, as they are in a drawing or drafting program, instead of bit-oriented, as in a paint program. This means that you can select headlines, legends, footnotes, and clip art, and then manipulate them as units. You can expand, stretch, rotate, copy, delete, or move them. You can alter their color, line thickness, or font.

The drawing program comes with a wealth of fonts, clip art, and other ready-to-use graphics items. The library that comes with *Graphics Gallery* includes 600 images; four additional portfolios, ranging in price from $95 to $195, are also available. There are borders, corners, arrows, and icons. There are even full blocks of color that you can use to create graduated backgrounds for your images.

SOMETHING IN COMMON

Both the charting and drawing programs share some common features. They both use the same eight function-key choices displayed across the bottom of the screen—similar to HP's Program Applications Manager user interface. They both make extensive use of a mouse, which generally makes the programs easier to use. They support a wide range of output devices and offer "plotter pen shielding," which keeps plotters from drawing the hidden elements of an image when it is partially covered by something else.

The other similarity between the two modules is that they are not as easy or as flexible to use as the features mentioned up to this point might imply.

For example, under the Charting module, there are few data-import options. A graph that has been defined as part of a *1-2-3* or *Symphony* worksheet can be brought in, but the data can't be read directly from a worksheet file. A .DIF (Data Interchange Format) file can be imported, but you can't select columnwise or rowwise orientation. Since many other programs don't offer this control either, you may be stuck with your .DIF data going the wrong way, so your Years might be on the *y*-axis and Total Dollar Sales on the *x*-axis. Even when you do get the orientation correct, you may well have to reenter the row headings by hand. The only other form that the program will accept is a fixed-length file, but there must be space between the columns.

The Graphics Gallery Collection does an excellent job of replacing colors with gray-scale shading.

Other problems appear in the Drawing module. For instance, when you place a large image behind other elements, such as a graduated color background under text lines, it's often difficult to select the text and not the background. In some cases, I had to move or delete the background so that I could work with the text, and then I had to bring it back when I was finished. Another problem in Drawing is that although you can select multiple objects, you must use a Shift-Enter combination that induces you to let go of the mouse each time. (You can keep hold of the mouse by using your free hand to hit both the Right Shift key and Enter, but a Shift-click combination as used by the GEM interface would be far easier.)

The Drawing module also fails to offer some rudimentary graphics support, such as drop shadows for text and clip art. Additionally, it suffers from limited import/export capability; it can only import text directly. You must use a separate conversion utility to go to or from .CGM format. You can also write a picture to .EPS, TIFF, .PCX, HPGL, .PCL, or VideoShow formats, but you cannot import those formats. This is certainly handy for output, but a serious limitation for input since it precludes using scanned images unless you can get them to a .CGM format first.

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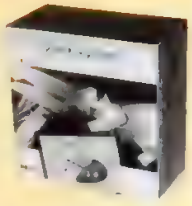


***The Graphics Gallery Collection*, Version 3.0**
Hewlett-Packard Business Computing Systems, 19091 Prunendge Ave., Cupertino, CA 95015; (800) 752-0900.
List Price: $499 (*The Charting Gallery*, $249; *The Drawing Gallery*, $349)
Requires: 384K RAM; two floppy disks with at least one high density; mouse; GGA, EGA, VGA, or Hercules graphics display, DOS 2.1 or later. (512K RAM and hard disk drive recommended).
In Short: *Graphics Gallery* can be used to produce attractive and well-designed graphs and charts. Many users will look no further when they find it, which is unfortunate; its flawed interface and clumsy modular approach make it harder to work with and more limited in its capabilities than the top competitors

CIRCLE 398 ON READER SERVICE CARD

Finally, the slide-show feature exists within the *Graphics Gallery*, but not in the way you might expect. You must create a separate command file (using your favorite text editor) that runs like a batch file to display the slides you want. The commands offer rudimentary control, such as next and previous slide and start over, but no manual/automatic control toggling. There are also no special effects or built-in script editor. One small advantage of this feature is that it can be used to batch print and update pictures based on revised data files.

If there were no other package in its class, *The Graphics Gallery Collection* would be an attractive program. Fortunately, there are competing products that produce results as good or better and do so with far less effort, while offering more control. Don't be swayed by the siren's song of the pretty pictures that *Graphics Gallery* can make—you can do better elsewhere.

Harvard Graphics

by Kellyn Betts

As the field of presentation graphics evolves, *Harvard Graphics* is beginning to resemble a once-grand old building that's been enlarged too many times by too many different architects. Like its predecessors, Version 2.12 of the $495 package is superb in many ways, but it's losing its edge.

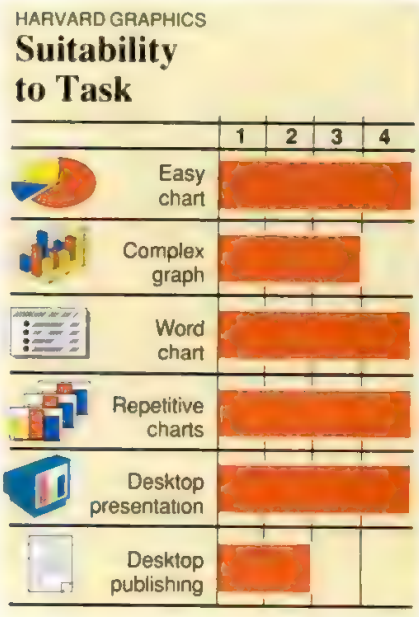
The trendsetting program that came into the world nearly 4 years ago as *Harvard Presentation Graphics* simply no longer provides all the features and functions we demand. It recognizes fewer file types than any of its peers reviewed in this issue (though it does import and export most of the important ones, including .WKS, .WK1, ASCII, .CGM, and .EPS), and it can graph far fewer elements per data series and data series per chart. It supports only six text fonts (which are sized by the percentage of the screen they take up, rather than in standard pica sizes) and it can't access printer-based fonts. It doesn't convert color images to gray-scale images. And its standard clip-art library is among the smallest, with comparatively primitive images.

Compounding the program's woes is its old-fashioned, often inconsistent text-based interface. *Harvard Graphics* is still easy to use, but, as people at Software Publishing admit, new users have started to complain that the package isn't as easy to learn as it might be. This development can probably be blamed on the proliferation of graphical user interfaces like *Windows*. The package—especially its textually-oriented drawing module, which is the only one of this group to lack a zoom feature and orientation control—just isn't as intuitively easy to use as a GUI-based presentation graphics program. In comparison, its interface seems almost crude, with vital information appearing all over the screen and keys that sometimes have one function, sometimes another. The batch file add-ons only highlight the patched feeling the program is beginning to take on.

Just supporting *Windows* isn't the answer—if it were, *Harvard Graphics* would never have tied with or beaten out *Windows*-based packages as an Editor's Choice the last three times we reviewed presentation graphics packages. And you can criticize the beauty of a design only after it's been proven functional. *Harvard Graphics* has been the trendsetter in this field for a long time, and most of the more-impressive PC presentation graphics features appeared first in this program. For example, the presentation management capabilities—most importantly a slide-show facility—that characterize the latest evolution of the genus Presentation Graphics have been present in *Harvard*'s repertoire of features for two and a half years. And it's still the only PC-based program of this bunch to offer a spelling checker for word charts.

TEXT A FORTE

As its inclusion of a spelling checker attests, creating text-based charts—which are, after all, the type of charts most frequently used in presentations—is one of its fortes. It has easy-to-use templates for creating automatic bullet, title, list, multicol-



umn table, and organizational charts; you can also produce free-form text charts. The package supports almost every simple text-entry option you can think of, from word wrap to justification to alignment and indention control. And if you're creating a series of text-based charts—or data-dependent graphs, for that matter—you can simplify the process considerably by creating a template and saving it into a chartbook.

Producing standard data-based graphs with *Harvard Graphics* is also easy, whether you import the data from a .WK* spreadsheet with the package's live links or key it in yourself. The software can create all the standard graphs: bar, pie, line,

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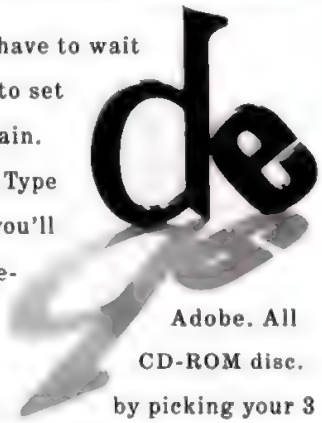

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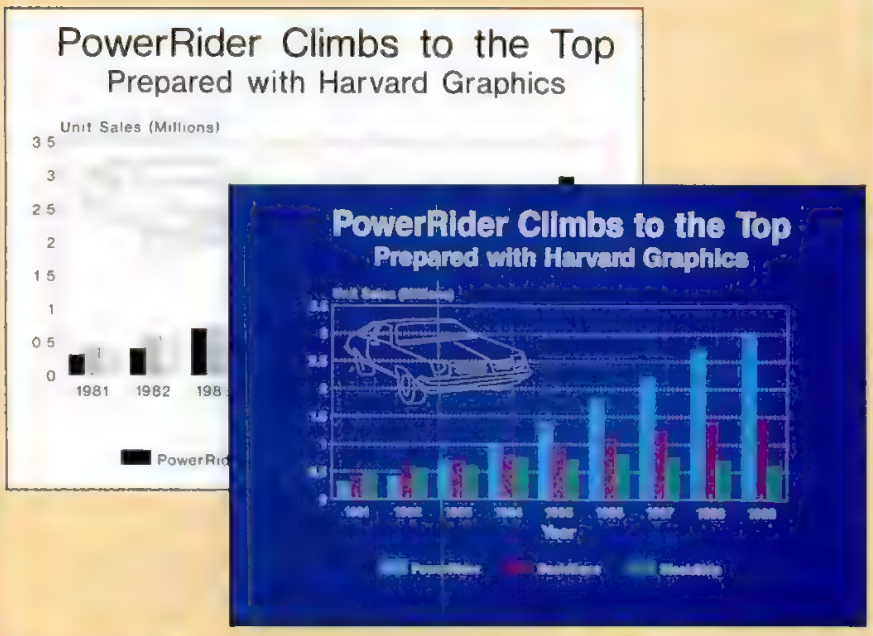

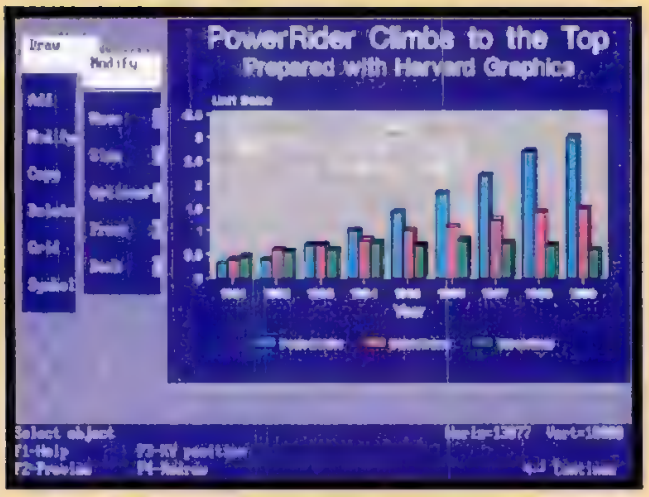

Harvard Graphics has nested-column menus that fill the screen from left to right, allowing you to choose options within options. The $495 text-based program's draw module is its weakest component but provides enough options and clip art (300 items in the standard library) to meet most users' needs.

only a minor upgrade, from Version 2.1 to 2.12. This upgrade added support for the Autographix slide service, which is available through a batch file and includes a communication module. It also added support for a color PostScript printer and the Tektronix Phaser CP and improved the printer drivers for the HP PaintJet and the Colormaster as well as buttressing the program's metafile importing capability. These are fine additions, but the program remains little changed from Version 2.0, which first came out in July of 1987.

In order to regain its position as the leader of the PC-based presentation graphics market, *Harvard Graphics* needs a major overhaul. It's long overdue, and the people at Software Publishing say it's in the works, although they won't divulge when it may hit the market. Until it does, *Harvard Graphics* is a good choice, but no longer *the* package to buy.

FACT FILE

***Harvard Graphics*, Version 2.12**
Software Publishing Corp., P.O. Box 7210, 1901 Landings Dr., Mountain View, CA 94039; (415) 335-2000.
List Price: $495
Requires: 512K RAM (640K for macro program); CGA, EGA, VGA, MCGA, or Hercules Graphics display; DOS 2.0 or later
In Short: A still-great program in need of an overhaul to avoid becoming an also-ran. Easy to use and ideal for creating word charts, the package is the only one with a spelling checker.

CIRCLE 399 ON READER SERVICE CARD

Kinetic Graphics System

by Robin Raskin

In the heart of bourbon country, in a huge complex in the Distillery Commons that sports its own slide production center, lies Kinetic Presentations, purveyor of a familylike approach to presentation graphics. The $495 *Kinetic Graphics System* is really five separate graphics programs, with five separate loose-leaf-bound manuals, giving it the undeserved appearance of being cumbersome.

All of its programs share a common interface and main menu. From the main menu, Kinetic Words creates word charts, Kinetic Art is responsible for drawing, Kinetic Graphs handles data charts, Kinetic Layout offers a quick-and-dirty way to combine various chart types, and Kinetic System houses the presentation management, utilities, and communications modules.

The good news is that each component of the program is robust but still easy to use. The bad news is that you'll often find yourself switching from module to module, and from manual to manual, to put together the composite presentation.

The user interface packs plenty of functionality but doesn't win any prizes for state-of-the-art or ergonomic design. You'll need to reference the manual to view available fonts, fills, line thick-

scatter, area, and high-low; it can even create graphs of more interest to scientists, such as regressional analyses, log-log, and semi-log plots. All of these graphing features are made easier by consulting the program's excellent manual, which does quite a good job of explaining graphic theory, at least for novices.

None of what's been related thus far is news; all of it and more (for example, that five extra-cost add-ons, including an additional 300 pieces of higher-quality clip art, are available for the program) can be found in the review we did of *Harvard Graphics* a year ago in the Desktop Solutions section of the September 27, 1988, presentation graphics blockbuster. Since the last time we reviewed it, *Harvard Graphics* has had

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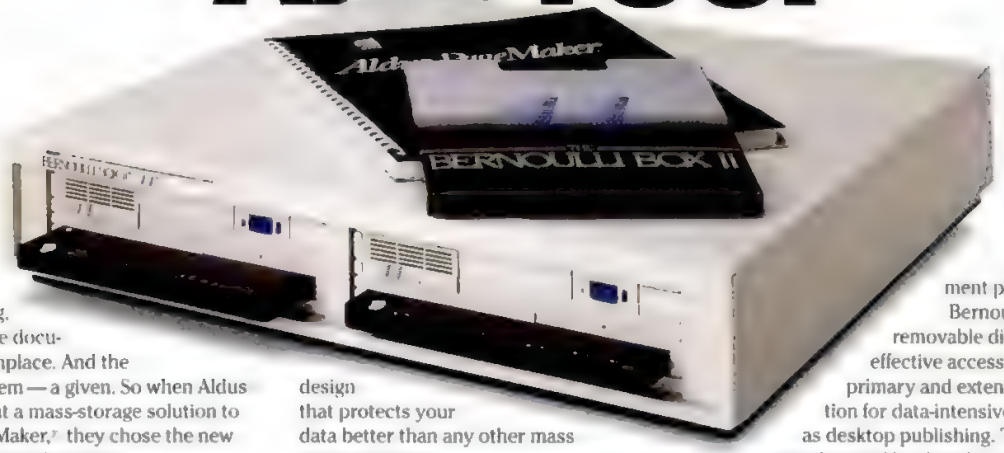

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CIRCLE 378 ON READER SERVICE CARD

PROJECTIONS FOR THE PC AS PROJECTOR

by William L. Coggshall and Robin Raskin

A crucial component of this latest crop of presentation graphics software is the ability to create on-screen "slide shows," which are also called desktop presentations, or, to use the preferred industry term for these computer-delivered visuals, electronic presentations. No matter what you call them, Desktop Presentations Inc. believes that they will grow much more rapidly than the other two popular presentation media.

Suddenly, after refining the process of getting presentation images off the screen and output to slides and overhead transparencies, we're back to the computer screen. DPI predicts a 14-fold increase in "frames"—electronic equivalents of 35mm slides and transparencies—from 1987 to 1992 (see graph). (This estimate does not not include video presentations.) These frames will be delivered to the viewing public by popular PC- and Macintosh-based presentation graphics programs, standalone processors like General Parametrics' VideoShow (or coprocessors like Computer Support Corp.'s *PC Emcee*), and PC animation software like IBM's *Storyboard Plus*.

In many ways the computer screen is the ultimate output device. It's comparatively easy to optimize your design for screen output, since, after all, the screen is what you design on. Last-minute changes are a matter of file substitution, not reimaging. Instead of waiting a few hours for your slides to be processed if you've got a film recorder, or at least a day if you're using an outside processing service, a last-minute addition or deletion takes but a few moments to implement. Production costs are low—almost nonexistent. Perhaps not with the current technology, but ultimately the on-screen presentation is more interactive. When someone in the audience raises his hand and belligerently asks you, "But what would happen in 1995?" you can give him the answer in a matter of seconds.

SLIDELESS SLIDE SHOW

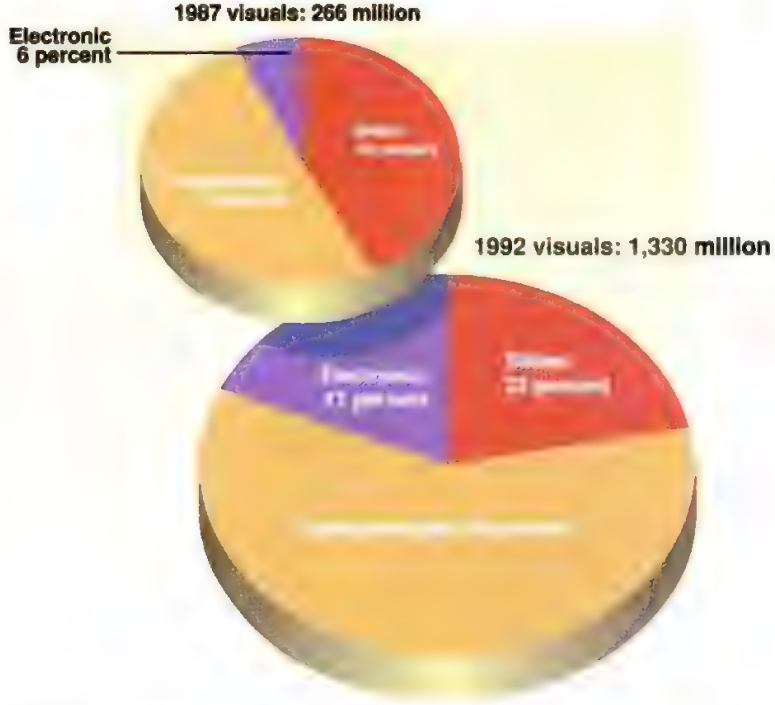
The slide-show feature in most of the packages we've reviewed is fairly straightforward: it enables a series of charts you create to be strung together and presented one after the other. You can select from a variety of preprogrammed transition effects (fades, wipes, dissolves, venetian blinds, for example) to keep your audience alert while you change "slides." Generally you change visuals by hitting a key on the keyboard or clicking a mouse button, but wireless remote devices are available from companies such as Computer Support Corp. and Presentation Electronics; these free you from having to hover over the keyboard.

Admittedly, the implementation of the slide-show capabilities in some of the older packages is a bit strained. They let you pick from a selection of filenames and arrange them in order. Contrast that with Xerox's approach, where miniature thumbnail sketches of every frame in the presentation appear on-screen. You rearrange a show by clicking on the miniatures and dragging them into place.

Finally, standard computer monitors are not the only hardware on which you can view electronic presentations. Besides large-screen monitors like the Mitsubishi XC-3710SS (which are relatively expensive and cannot be used for large gatherings), there are new "electronic slide projectors," such as the Kodak LC500, that provide a glimpse of things to come. Considerable advances are also afoot in the fields of color and high-resolution LCD projection pads. Large panels capable of plugging into a standard monitor port are available from Kodak, Sharp Electronics, nView, Chisholm, and others. The PC Viewer 480GS/2, $2,995 from In Focus Systems of Tualatin, Oregon, stores images in RAM and connects to almost any PC or Apple. LCD panels have yet to break the color barrier, however; this unit uses gray scales and dithering techniques to bring electronic presentations to larger audiences. ■

SHARE OF PRESENTATION MEDIA

Growth for Electronic Frames



Source = Desktop Presentations Inc.

nesses, and other attributes, since they are referenced by number in the program.

Kinetic uses a single Lotus-like command line that runs across the bottom of the screen. You enter commands via a combination of Shift and function keys or letter commands or by moving the cursor to the command. The Word and Graph commands invoke fill-in-the-blank worksheets. You create an image by describing it in the worksheet. The graphic is displayed only when you press F9 (a quick draw without filled fonts) or Shift-F9 (a full preview).

The single-line menu scheme is more obtrusive in the Art module of the program. For example, you must first select the Pick command to identify the object and signal the program that the selection is done by pressing F8. Then you've got to backtrack through the menus to select the next edit action, such as Change. Change brings up another set of menus, and so forth. It works, but it's not especially fluid.

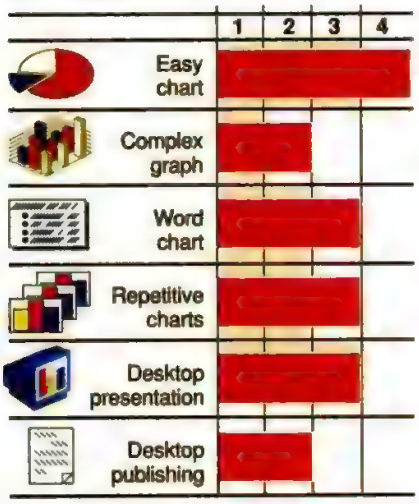
KINETIC WORDS

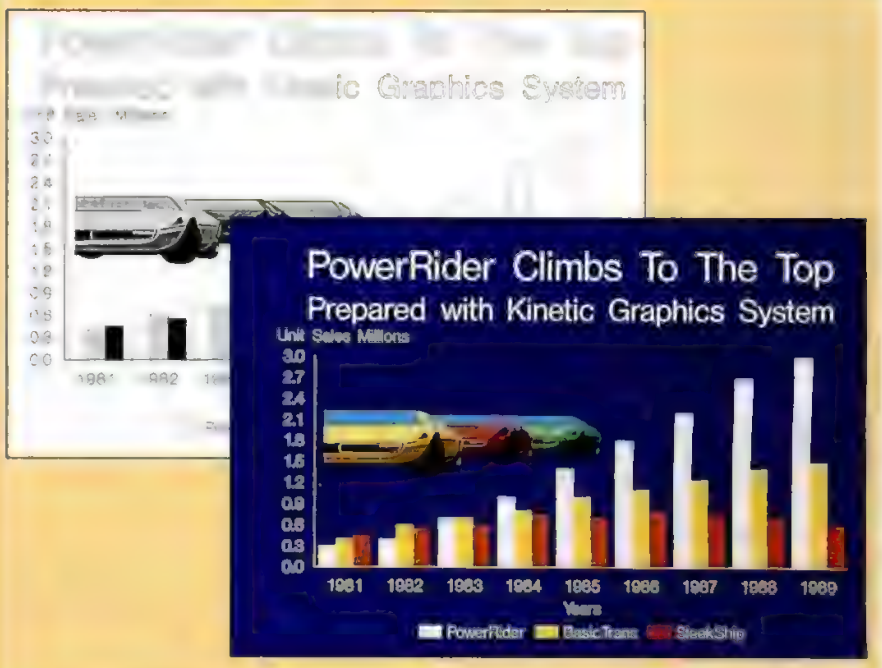
The Words module revolves around an antiquated but well-behaved text editor. You type text into a lined notepad-style worksheet and use the adjacent checklist to indicate font, size, and color information. Ctrl keys insert embedded commands into the text for underlined, centered or bulleted text.

Because the program has a number of modules, you'll spend some time puzzling where to get the job done. For example, you can create a table chart using tab stops and the text editor in the Words module.

KINETIC GRAPHICS SYSTEM

Suitability to Task





Designing by forms isn't so bad if you're using the *Kinetic Graphic System*'s worksheet. The data entered into the worksheet is linked to this graph description at the Data File prompt. The worksheet is part of Kinetic Graph, which is one of the five modules of the $495 command-driven program.

Or, you can use the Graphs module's table to enter row and column information and enter the text in the Art module. The Words Module is better for tables with no borders, Graphs and Art are better for those with borders.

Creating a composite image that relies on work created in two *Kinetic* modules can be baffling. *Kinetic* stores files created in each module with a different file extension, and you're never quite sure which file is needed where. So, to create a bar chart, you create and store both a data file and a chart description. These must be linked in order to produce the on-screen graph. If you want to annotate the graph, the file must be converted into an image file (a .CGM file) and brought into the Art module (you can choose automatic image-file creation as a default). Once in the Art module, the graph can no longer be modified. Similarly, layout files and word files must be converted to .CGM image files before they are output to any device.

One advantage of keeping image elements in different file structures is that the savvy user can create templates. For example, a chart definition, which is a fill-in-the-blank checklist of attributes for a graph, can be linked to any data worksheet to create a variety of graphs. Also, a graph, saved as an image, can be overlaid onto other graphs or text as though it were just another picture.

TAKE CHARGE

Drowning in information?
All those phone numbers, bright ideas, schedules, reports, stray facts, and to-do lists aren't going to stop coming at you fast and furiously.

You need a better way to manage it all. So everything's organized and at your fingertips. So separate pieces are pulled together into a coherent whole. And you get on top of the information, using it to forge ahead in your work -- better and faster.

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The first Personal Information Manager that really works.
Instant Recall is the only full-featured PIM that's memory resident, *popping up over any software you're using* -- word processor, spreadsheet, whatever. An incredible timesaver. And something not offered by any other personal information manager.

Plus, it's memory resident in *just 32K* (about half the memory eaten up by Sidekick®) -- leaving plenty of room for other programs.

$99.95

Instant Recall goes way beyond desktop organizers like Sidekick®. It makes connections between pieces of information. Gives you multiple perspectives. Creates timelines from dates you've entered piecemeal. In other words, *it starts to shoulder much of the work for you.*

And it's truly easy to start up and use.

Instant information: the way you need it.
Instant Recall takes any kind of information you toss into it. Structured or freeform. Four familiar formats handle it all:

Notes: For freeform text -- ideas, memos, lists, tables, reports.

Tasks: For monitoring and delegating, with priorities and target dates.

Schedule: For blocking out time -- with automatic conflict checking, one-time entry of recurring events, and week-at-a-glance time display for one or more people.

People: For names, addresses, phone numbers, unlimited notes. With follow-up dates, on-screen reminders, and a phone dialer. Plus, address export to your word processor...you'll never type an address again!

Any single entry can include up to 65,000 characters. That's 30 pages of text.

Integrated views actually make connections for you, speeding your work.
Use Instant Recall's integrated views to *pull together different types of information relating to a topic, a date or a person -- or any other category you choose.* Further refine it by *priority.* Add a fine-tooth comb with powerful "and/or/not" text search operators.

Now something remarkable starts to happen: You observe relationships between pieces of data -- something desktop organizers like Sidekick® or text databases like Tornado™ simply can't show you.

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Because Instant Recall meshes the data *your* way...forging the links...provoking the insights...stimulating your creativity. You import and export text and numbers to other programs. Important items show up on screen. You follow up almost automatically. And because it's memory resident, Instant Recall pops up over any other software that's running, providing information with lightning speed. Something other PIMs like Lotus Agenda® cannot do.

Ready to use right out of the box.
Instant Recall comes ready to work for you from day one. Its intuitive user interface and context-sensitive help make it exceptionally easy to learn and use.

You don't have to retype information that's already on your machine -- Instant Recall has a built-in clipboard for pulling information directly from other programs and ASCII files. Plus transfer utilities for Sidekick®, Tornado™, MemoryMate® and delimited ASCII.

Unique additional features lighten your load.
Instant Recall is the *only* general-purpose PIM offering a pop-up activity timer, a phone dialer, alarm messages, scheduling for multiple people, automatic conflict checking, advance notification, plus one-time entry for recurring activities.

Other convenient features include mailing lists and labels, direct copy of name and address to any word processor, overdue notice, follow-up dates, password protection, flexible printed reports and a clipboard for moving text in and out of Instant Recall.

Take charge -- risk free.
Experience the difference Instant Recall makes -- the remarkable gain in control, speed, and effectiveness. You can't lose. Because this cutting-edge PIM is completely guaranteed. If you're not 100% satisfied, return the cover page of the manual for a full refund. The disks are yours to keep and reformat.

Get on top of everything. And stay there. For just $99.95.

For faster service order toll-free: **1-800-848-4970**

Hardware Compatibility
IBM PC, XT, AT, PS/2 or compatible with 512K RAM, DOS 2.1 or higher (DOS 3.0 or higher for memory resident operation), and at least 720K of floppy or hard disk capacity.

CIRCLE 541 ON READER SERVICE CARD

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METHOD OF PAYMENT PCM

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Credit Card # _____ Exp. Date ____

Signature _____

5152 N. Oracle, Suite 210, Tucson, AZ 85704

All the major chart types are supported, and *Kinetic* does an admirable job of producing what it calls histograms and what we call true 3-D bar charts. Despite the rigid, fill-in-the-blank, nongraphical user interface, there are many options for enhancing and customizing your graphs. Even novices will enjoy using the checklist of options as they experiment.

IMPORT/EXPORT

Data import from *Lotus 1-2-3*, ASCII, and .DIF are all supported. The *x*-axis text is stored in the first column, and since you can import by row or column, a good, clean import is fairly attainable. Graphics import/export is a weak link in the program. Currently the program supports only .CGM import and export. .CGM has earned its reputation as a pesky standard, since there are so many variations—text only, binary, and so on. Kinetic also offers a $99.95 utility for converting *AutoCAD* files to *Kinetic* formats and will be incorporating a PostScript export capability soon.

Kinetic uses its own built-in fonts—ten of them in all. Four are designed to produce attractive plotter output, and the others are general-purpose fonts. The included fonts are attractive and available in a virtually unlimited number of type sizes. Those who don't want to bother with the headaches of downloadable and device-dependent fonts will love *Kinetic*'s simple but utilitarian approach. The clip-art library—one of the smallest offered by a package reviewed in this issue—contains over 300 images including simple icons as

PC MAGAZINE FACT FILE

***Kinetic Graphics System*, Version 1.51**
Kinetic Presentations Inc., 250 Distillery Commons, Louisville, Kentucky 40206-1990; (502) 583-1679.
List Price: $495 (modules can be sold separately for $125 apiece).
Requires: 640K RAM, DOS 2.0 or later. Hard disk and mouse recommended.
In Short: The *Kinetic Graphics System* handles word, data, and drawing charts with equal aplomb, albeit with a traditional command-driven, nongraphical user interface. It supports only .CGM as a graphics import/export standard, and because the program is organized into distinct modules, creating the composite seems a bit fragmented.

CIRCLE 400 ON READER SERVICE CARD

PRESENTATION GRAPHICS SOFTWARE: SUMMARY OF FEATURES

PRESENTATION CAPABILITIES

Can view file as series of thumbnail sketches Can show several stored images in miniature on one screen or printout.

Generates speakers' notes automatically Can split the screen to display and output graphics images together with half a "page" of text explaining, for example, the relationships illustrated by the images.

Converts color automatically to black and white Takes a color graphic and automatically converts it to black and white so that it can be output to a laser or dot matrix printer. This is typically done using pattern shading in place of the original colors.

Offers gray-scale control Helpful in converting color slides or graphics for output to devices that support gray scales. It lets you change the shade of gray mapped to a color if, for example, two colors appear to be nearly the same shade of gray.

Allows transitional effects between slides Handles wipes, fades, blinds, falls, cascades, dissolves, spirals, and other ways of changing images on-screen.

Creates runtime screen shows Enables the user to save images to a floppy disk and run them on any machine without loading the program as a whole.

STANDARD CHART AND GRAPH TYPES

Text/word charts The most commonly used chart types by far, the vast majority of text/word charts are created as unformatted *free-form* text. Some of these packages have templates that create *automatic bullets* or automatically numbered *formatted lists*, as well as larger-size (perhaps boldfaced or shadowed) text for *formatted titles*.

Techniques for exploding pies *Automatic* — the slice is pulled out to a predefined distance set by the program; *user-defined distance* — you specify the amount to pull out a slice by typing in a number or a coordinate location; *yank and place* —you drag the slice out to a location and then drop it into place.

SCIENTIFIC CHARTS AND GRAPHS

Statistical, grouping, or summary operations Any of several math capabilities used for sorting and understanding data prior to producing graphs.

CHARTING FEATURES

Number of line types The number of different thicknesses and variations on solid lines.

Number of line symbols The number of possible representations of a data point on a line.

OUTPUT DEVICES

VideoShow The standard desktop presentation device that allows you to make slides with another device or create traditional slide-show presentations from a floppy disk.

DATA IMPORT/EXPORT

.WKS or .WK1 The *Lotus 1-2-3* worksheet file formats.

.DBF The *dBASE II* and *III* data file format.

.DIF (Data Interchange Format) Supported by *VisiCalc* and many other programs.

SYLK Supported by *Multiplan* and many other programs.

GRAPHICS IMPORT/EXPORT

.CGM (Computer Graphics Metafile) A binary description of a final image created by the software, .CGM is a generic format (much like ASCII for word processing documents).

PostScript A device-independent page-description language. Essentially, a graphics package sends PostScript code to a PostScript printer.

.EPS (Encapsulated PostScript) As the name suggests, .EPS is a condensed form of object definition that works with the descriptions of the various elements within an object rather than with the physical elements themselves.

.PIC The *Lotus 1-2-3* graphics file format.

HPGL (Hewlett-Packard Graphics Language) A file format used with HP-compatible devices.

.DXF (Drawing Interchange File) The format produced by *AutoCAD* —a standard ASCII text file that can be easily transferred to other systems.

.TIF (Tagged Image File Format) Used primarily by Aldus's *PageMaker*.

.WMF The *Microsoft Windows* Metafile graphics file format; works with any *Windows*-compatible program.

.PCX The *PC Paintbrush* graphics file format.

TYPEFACE FEATURES

Accesses printer-based fonts Takes advantage of the built-in fonts in various devices.

Number of typeface sizes within font family The number of point sizes available for the program's most completely supported font, from smallest to largest.

MISCELLANEOUS

Creates live link to spreadsheet Can view worksheet files from the graphics program and create a link between the graph and the data so that the graph is automatically updated whenever the data is altered.

Includes built-in chart gallery Selects a picture of a desired chart type (either from an on-screen representation within the program or from a chart format number listed in the documentation) and then calls up the template to "combine" it with raw data.

Has user-definable templates Modifies predefined charts or adds new ones and saves them to a chart book.

Maintains graphics style sheets A built-in collection of chart styles or templates for creating images.

CONTINUES

Designed for desktop graphics, priced to be personal.

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Plot your designs, present your plans, and illustrate your point with the new HI Image Maker.™ Houston Instrument's newest plotter can improve all your images at a price that makes personal productivity gains affordable.

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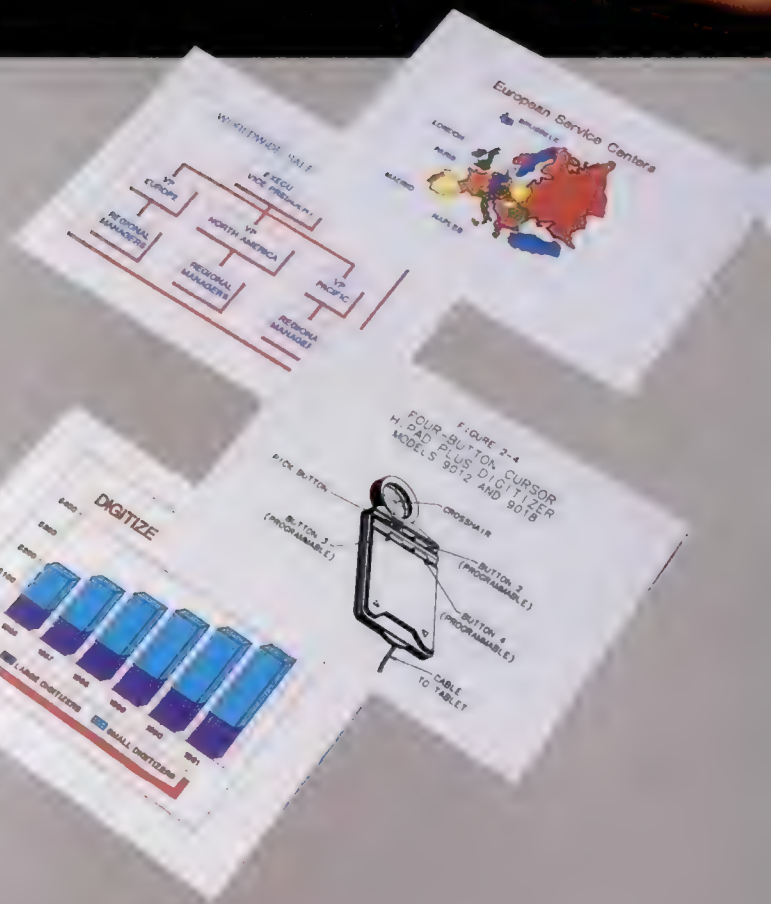
For details, call 1-800-444-3425 or 512-835-0900.

**U.S. suggested retail price. Subject to change.*



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CIRCLE 117 ON READER SERVICE CARD

PRESENTATION GRAPHICS SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	SlideWrite Plus $445	Graph Plus $495	Harvard Graphics $495	Kinetic Graphics System $495	Lotus Freelance Plus $495	Xerox Presents $495	The Graphics Gallery Collection $499
PRESENTATION CAPABILITIES							
Can view file as series of thumbnail sketches	○	●	○	○	○	●	○
Rearranges elements in presentation file	●	●	●	○	●	●	●
Generates speakers' notes automatically	○	○	●	●	○	●	○
Converts color automatically to black and white	○	●	●	○	●	●	●
Offers gray-scale control	○	●	○	●	●	●	●
Allows transitional effects between slides	○	● (17)	● (11)	○	● (14)	● (14)	○
Creates runtime screen shows	○	○	● (at extra cost)	○	● (at extra cost)	○	○
ENVIRONMENT							
DOS versions	2.0 or later	3.*x*	2.0 or later	2.0 or later	2.1 or later	3.1 or later	2.1 or later
Microsoft Windows	○	● (2.*x*, /286, /386)	○	○	○	● (2.*x*, /286, /386)	○
RAM required with minimum DOS loaded	390K	640K	440K	384K	438K	640K (1MB recommended)	384K
RAM required with DOS 3.0 loaded	390K	640K	512K	512K	438K	640K (with DOS 3.1)(1MB recommended)	384K
Supports LIM EMS	○	○	○	○	○	●	○
STANDARD CHART AND GRAPH TYPES							
Diagrams:							
Flowchart	● (with clip art)	● (with clip art)	●	●	●	●	●
Organization	●	○	●	●	●	●	○
Text/word:							
Automatic bullets	●	○	●	●	●	●	●
Formatted titles	●	○	●	●	●	●	○
Formatted list	●	○	●	●	●	●	○
Free-form text	●	●	●	●	●	●	●
Multicolumn tables	○	●	●	●	●	●	●
Bar (horizontal and vertical):							
Stacked	●	●	●	●	●	●	●
Overlapped	●	●	●	●	○	○	○
Clustered	●	●	●	●	●	●	●
3-D	●	●	●	●	● (manual)	●	●
Bar with line	●	●	●	●	●	○	●
Pictograph	○	○	○	○	● (manual)	○	○
Pie:							
Exploded	●	●	●	●	●	○	●
Automatic	●	●	●	●	●	○	●

●—Yes ○—No

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	SlideWrite Plus $445	Graph Plus $495	Harvard Graphics $495	Kinetic Graphics System $495	Lotus Freelance Plus $495	Xerox Presents $495	The Graphics Gallery Collection $499
User-defined distance	○	●	○	○	○	○	●
Yank and place	○	●	○	○	● (manual)	○	●
Multiple linked pies	●	●	●	○	●	○	○
Proportional pies	●	○	●	○	● (manual)	○	○
Line:							
Maximum number of data points per line	4,000	4.2 million	240	365	500	20	640
Maximum number of lines per graph	12	4.2 million	8	6	8	4	10
Scatter	●	●	●	●	●	●	●
Area:							
Stacked	●	●	●	●	●	●	●
Cumulative	●	●	●	○	●	○	●
Gantt	○	○	○	●	● (manual)	○	○
High and low	●	●	●	●	●	○	●
SCIENTIFIC CHARTS AND GRAPHS							
Regression analysis	●	●	●	○	●	○	●
Scientific axis numbering options:							
Linear	●	●	●	●	●	○	●
Exponential	●	●	○	○	●	○	●
Logarithmic (log-log or semi-log)	● (both)	● (both)	● (both)	● (log-log)	● (both)	○	● (both)
Statistical, grouping, or summary operations	●	●	●	○	○	○	○
CHARTING FEATURES							
3-D charts	●	○	●	●	●	●	●
True 3-D (with *x*-, *y*-, and *z*- axes)	○	○	○	●	○	○	○
Allows shading	●	○	○	●	○	○	●
Automatic scaling of chart elements:							
Discrete steps	●	●	●	○	●	●	●
Infinite steps	●	●	●	●	●	○	●
Text style options	●	●	●	●	●	●	●
Boxed letters	●	●	○	●	●	●	○
Drop shadows	● (manual)	○	●	●	●	●	○
Number of line types	12	5	4	6	5	5	7
Number of line symbols	12	10	13	7	8	5	8
Number of fill patterns	21	40	12	12	15	16	8
Can create cumulative charts	○	●	●	○	○	○	●
TEXT ENTRY OPTIONS							
Text editor	●	●	●	●	○	●	●
Word wrap	○	○	●	○	○	●	○
Spelling checker	○	○	●	○	○	○	○
Text rotation	●	●	○	●	●	○	●

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Tom bought Hewlett-Packard long

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When he got his first job on Wall Street, Tom's HP calculator was his most valued possession. It was the combination of innovation and reliability that gave him an edge. So when his Information Systems Manager recommended they go with Hewlett-Packard personal computers, Tom needed no convincing.

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CIRCLE 372 ON READER SERVICE CARD

PRESENTATION GRAPHICS SOFTWARE: SUMMARY OF FEATURES

(Products listed in ascending price order)

	SlideWrite Plus	Graph Plus	Harvard Graphics	Kinetic Graphics System	Lotus Freelance Plus	Xerox Presents	The Graphics Gallery Collection
	$445	$495	$495	$495	$495	$495	$499
Justification	●	○	●	●	●	●	●
Alignment control	○	●	●	●	●	●	●
Indention control	○	○	●	●	●	●	●
Margin control	○	○	●	●	●	●	○
Shrink-to-fit capability	●	○	●	●	●	○	●
GRAPHICS ADAPTER SUPPORT							
CGA	●	●	●	●	●	●	●
EGA	●	●	●	●	●	●	●
VGA	●	●	●	●	●	●	●
Super VGA	○	●	○	○	○	●	○
IBM 8514	○	●	○	○	○	●	○
Hercules	●	●	●	●	●	●	●
OUTPUT DEVICES							
Plotters (pen or electrostatic)	●	●	●	●	●	○	●
Dot matrix printers	●	●	●	●	●	●	●
Laser printers:							
PostScript	●	●	●	○	●	●	●
HP LaserJet	●	●	●	●	●	●	●
Color thermal	●	●	●	●	●	●	● (Xerox 4020)
Color laser	●	○	○	○	○	●	○
Ink jet:							
PaintJet	●	●	●	●	●	●	●
DeskJet	●	●	●	● (HP emulation only)	●	○	●
Film recorders:							
Polaroid	●	○	●	○	●	○	●
ImageMaker	●	●	●	●	○	○	○
Photometrics	●	●	●	● (via *VideoShow*)	○	○	●
Matrix	●	●	●	●	●	○	○
Celco	○	○	●	○	○	○	○
CalComp	○	○	●	○	●	○	○
Service bureau link	Brilliant Image, 11 others	.CGM, Slidemaster	Autographix	.CGM, Kinetic Super Center	Autographix, MAGICorp	Autographix	.CGM, .GAL, MAGICorp
VideoShow	●	●	●	●	●	○	●
DATA IMPORT/EXPORT							
.WKS or .WK1	●/○	●/○	●/○	●/○	●/○	●/○	●/○
.DBF	○/○	○/○	○/○	●/○	●/○	○/○	○/○
.DIF	○/○	●/○	○/○	●/○	○/○	●/○	●/○
SYLK	○/○	●/○	○/○	○/○	●/○	●/○	○/○

●—Yes ○—No

N/A — Not applicable: product does not have this feature.

	SlideWrite Plus	Graph Plus	Harvard Graphics	Kinetic Graphics System	Lotus Freelance Plus	Xerox Presents	The Graphics Gallery Collection
	$445	$495	$495	$495	$495	$495	$499
ASCII (text)	●/○	●/○	●/○	●/○	●/○	●/○	●/●
Requires hard carriage returns	●	○	○	○	○	●	●
Comma-delimited	●	●	●	●	●	○	○
GRAPHICS IMPORT/EXPORT							
.CGM	●/●	●/●	●/●	●/●	●/●	●/●	●/●
PostScript	○/●	○/●	○/●	○/●	○/●	○/○	○/○
.EPS	○/●	○/●	○/●	○/●	○/●	●/●	○/●
.PIC	○/○	○/○	○/○	●/○	●/○	○/○	○/○
HPGL	○/●	○/●	○/●	○/○	○/○	○/○	○/●
.DXF	○/○	●/●	○/○	●/● ($199)	○/○	○/○	○/○
.TIF	●/●	●/●	○/○	○/○	●/●	●/●	○/●
.WMF	○/○	●/●	○/○	○/○	○/○	●/●	○/○
.PCX	●/●	●/●	○/○	○/○	○/○	●/●	○/●
TYPEFACE FEATURES							
Number of typefaces included in package	16	0	6	10	11	8	27
Accesses printer-based fonts	●	●	●	○	●	●	○
HP-compatible	●	●	○	N/A	○	●	N/A
PostScript-compatible	●	●	●	N/A	○	●	N/A
Epson-compatible	○	○	○	N/A	○	●	N/A
Number of typeface sizes within font family	Device-dependent	Device-dependent	Scalable (from 1% to 99.9% of screen)	Scalable (from 1 to 500 points)	Scalable (from 1 to 100 mm)	Device-dependent	Scalable (from 1 to 901 points)
Supports Bitstream Fontware	●	●	○	○	●	●	○
All fonts available on all output devices	●	●	●	○	○	○	●
MISCELLANEOUS							
Creates live link to spreadsheet (import only)	○	●	●	○	●	○	○
Uses math coprocessor	●	○	○	●	●	○	○
Uses macros or script programming language	●	○	●	●	○	○	●
Includes built-in chart gallery (chart books)	○	●	●	●	○	●	●
Charts appear on-screen	N/A	●	●	○	N/A	●	●
Charts listed in documentation	N/A	●	○	●	N/A	○	○
Has user-definable templates	●	●	●	●	○	●	●
Maintains graphics style sheets	●	●	●	●	●	●	●
Can use existing charts/graphs as templates	●	●	●	●	●	●	●
Maximum number of on-screen colors	16	256	16	255	13	256	130
Maximum number of colors in package	16	16.7 million	Device dependent	255	Device dependent	16.7 million	130
Accesses printer-based fonts	●	●	○	○	●	●	○
Runs on network	●	●	●	●	○ (network tolerant)	○	○
Number of items in standard clip-art library	421	500	300	255	900	42	600

ENDS

well as more complicated symbols (Kinetic does offer a U.S. Maps library for an additional $195). The images can't be made to automatically fit an image to fill available space. There are also quite a few style templates and layouts.

Kinetic's on-screen presentation is more utilitarian than glitzy. Individual images can be consolidated into a collection and can either be output in batch form or displayed on the screen. There are no fancy transitional effects, but you can reverse to a previous image, and a QuickShow option lets you proof your slides on-screen without having to do a full redraw. The slide bureau link and job order form are built directly into the program and are no problem to use.

Kinetic's support staff is knowledgeable and helpful, and because the production centers support only *Kinetic Graphics System*, the slide production process is optimized. Spokespeople at Kinetic assure me they are busy at work to consolidate the manuals and program functions into one cohesive unit. Once they do, *Kinetic* might be a wise choice for the presenter who wants a non-*Windows*, integrated approach to presentations.

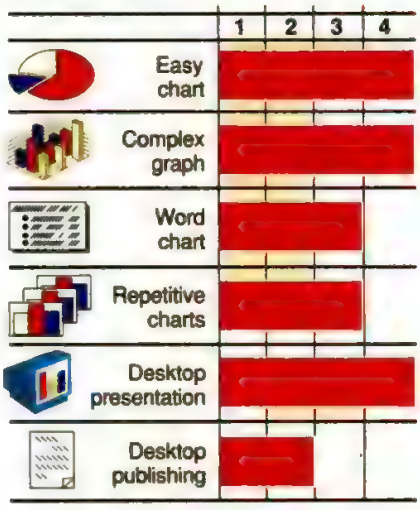
Lotus Freelance Plus

by Luisa Simone

Lotus Development Corp.'s presentation graphics package isn't exactly on the cutting edge of technology. Version 3.0 of the $495 package doesn't run under *Windows*, it doesn't take full advantage of VGA, it doesn't have templates, and it doesn't provide an absolutely faithful WYSIWYG preview of type characteristics. But despite its drawbacks, *Lotus Freelance Plus* is a pretty sharp graphics product—it cuts to the core of a business user's needs.

For one thing, *Freelance Plus* is ideal for PC-based desktop/electronic presentations. This program delivers superior screen-show capabilities by combining much of the functionality of Brightbill-Roberts' & Co.'s *Show Partner* with a Lotus-like interface. A straightforward form allows you to choose the sequence, duration, and any of 14 special-effect transitions for each image in your screen show. Best of all, you can take a runtime version of your show on the road. Unlike *Windows*-based graphics products like *Xerox Presents*, *Freelance Plus* allows you to run your presentation (using a small utility) directly from the DOS prompt.

LOTUS FREELANCE PLUS
Suitability to Task



That's just the tip of the iceberg, since Screen Show is only one of the three modules of *Freelance Plus*. The Portfolio module may seem relatively unimpressive—until you need to keep track of various images for several presentations stored in different subdirectories. In addition to providing invaluable management functions, Portfolio can also perform batch-printing operations.

But the nitty-gritty work of creating a graphic image happens in the third module—Charts and Drawings. Think of the charting function as data entry with lots of formatting control. *Freelance Plus* may not have *Windows*' dialog boxes, but within the data entry form, individual submenus (invoked by hitting the Spacebar) control all of the formatting features with clarity and ease. You can use these forms to enter data directly via the keyboard, but the menus help you to choose chart types; to import data from external files (including .WK3 for *Lotus 1-2-3* 3.0); to manipulate axis scaling; and to determine the various fonts, rules, and colors used in the final image.

However, navigating the data entry forms reveals several of the program's limitations. For example, you are allowed to have only 12 colors on-screen (13 if you include the background)—even if you use VGA. I was annoyed when the program restricted my use of live links to a spreadsheet to only eight columns. (Importing, rather than linking, the data solves this problem and ups the maximum number of columns to 140.) Also, for some strange reason, you are not allowed to choose shadows as a type option when you are printing to the HP LaserJet.

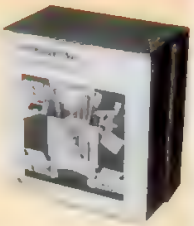
EXTENSIVE DRAWING TOOLS

Of course you can add shadows manually. In fact, if you have the time and the creativity, you can use *Freelance*'s extensive drawing tools to compensate for any weaknesses in the product. So, while *Freelance* cannot create speakers' notes à la *Harvard Graphics* or *Xerox Presents*, you can reduce the size of your chart to a thumbnail and add free-form text on the drawing page to achieve the same result.

Freelance's drawing tools extend beyond all of the things you expect (like geometric primitives or free-form polygons) to include capabilities like object smoothing or making the background of a TIFF file transparent. That last command was a real boon when I decided to change the color of the imported test logo and found myself confronted with a white logo on an ugly black rectangle on a royal blue background. *Freelance* also provides a second page for each drawing—a handy workspace for creating additional charts or importing clip art.

The clip-art library included with the program is more than adequate, with 900 images and symbols—it's larger by far than any of the libraries that come with the other programs being reviewed. (Two special-interest map libraries, U.S. Complete for $395 and Continents and Countries, are also available.) You can save yourself a lot of work by importing an organizational

FACT FILE



***Lotus Freelance Plus*, Version 3.0**
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; (617) 577-8500.
List Price: $495
Requires: 438K RAM, hard disk, DOS 2.0 or later.
In Short: *Freelance Plus* proves that you can still run an efficient and powerful graphics program from the DOS prompt. Although it needs improvements on several of the output drivers, this program provides an extensive clip-art library, a full array of chart types, the ability to handle large data sets, and flexible drawing tools for the average business user rather than for the art professional.

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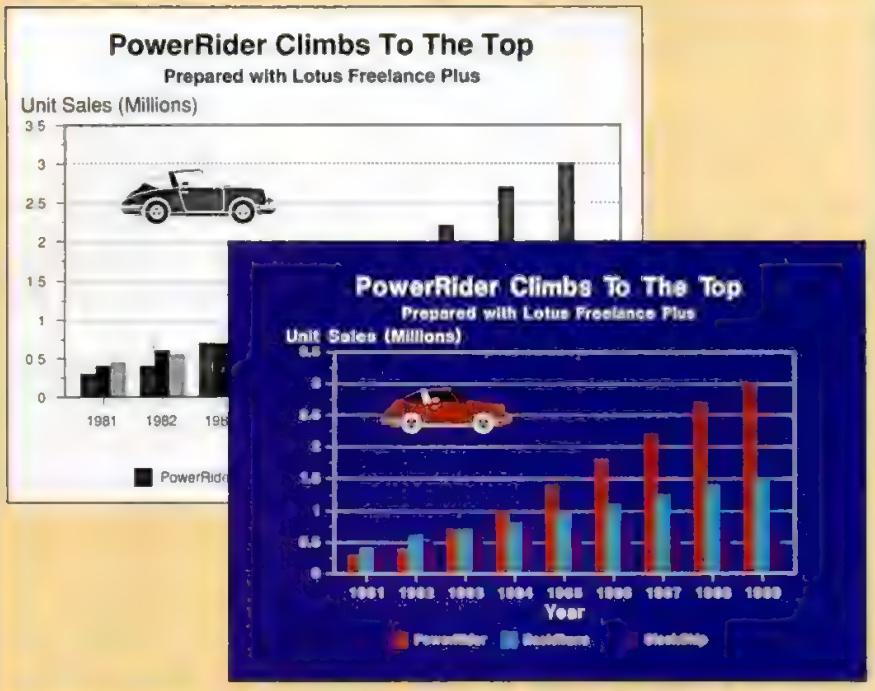

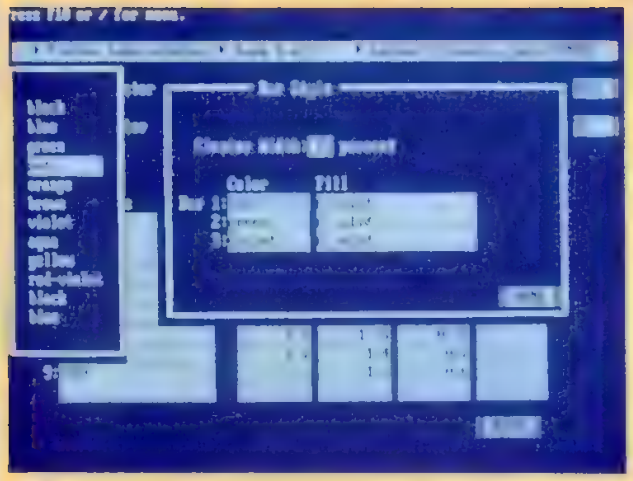

Lotus Freelance Plus is made up of three separate modules: Charts and Drawings, Portfolio, and Screen Show. One of the unique features it offers is a runtime version capability. You can take your show on the road, on a floppy disk, and display it on virtually any PC.

chart symbol rather than drawing it from scratch. Although the clip art is imported as an outline, if you choose Fill from the Edit menu, you'll discover detailed colorization for each object. Even though you might be tempted to fiddle with the color, don't, you lose most of the detail if you do.

Much of *Freelance*'s power, and unfortunately many of its problems, reside in the Print/Options menu. On the plus side, *Freelance* allows you to switch quickly among five different device drivers. If you load a new driver before you call up a drawing, you must instruct *Freelance* to automatically resize the graphic for a different output device. Turn on the substitution feature for fill patterns or gray scale, and *Freelance* will automatically convert color screen images to black-and-white output for your printer. The program will even let you change the way it maps color to gray scale if not enough contrast is provided.

The negative aspect of switching among drivers is that you'll have to fine-tune each version of your drawing, because type and color specs do not necessarily translate across formats. For example, because the Matrix driver doesn't support TIFF files, our test logo did not appear in the slide. It will also take some experimentation with the Matrix driver to discover which screen colors translate well to 35mm slides. (Other film-recorder drivers may work differently.)

Freelance was weakest when exporting complex files to *PageMaker*. Both the TIFF and .EPS files of the test-bar chart printed erratically. But for most other graphics applications—screen shows, slide generation, and direct printer output—*Freelance* is lean and mean. A new version, soon to be released, will require only 436K of RAM, leaving room for TSRs and background programs. It can also handle large data sets—if you use data sets efficiently, you can create graphs with up to 2,000 data points for a line chart, 1,800 data points for x-y scatter charts, or 520 individual bars.

Simply stated, *Lotus Freelance Plus* creates professional-looking, information-laden charts and graphs. This program proves that you don't have to be on the cutting edge of technology to slice through your work load.

SlideWrite Plus

by Robin Raskin

A full-featured business graphics program, *SlideWrite Plus* has traditionally been strong on data-driven charting. In version 3.1, the folks at Advanced Graphics Software have attempted to hone the $445 program's drawing and output capabilities, giving fonts and clip art a higher priority. Still, because of its function-key-oriented menus, the program is most likely to appeal to those with data on their minds, especially scientists and engineers.

SlideWrite Plus's built-in statistical capabilities, array of curve-fitting charts, Greek and math fonts, support for macros, batch printing mode, and the sheer number of chart types it supports make it a powerful program for those who need to show off with numbers. In fact, data is so important in this program that it gets its own entry mode. The other two modes are for entering text and drawing.

In text mode a single-line text editor lets you quickly type in text, while a series of function-key commands assigns text attributes. In the data mode the function keys invoke full-screen data and design worksheets. You create a chart by filling in the requisite blanks. With the exception that you'll need to use the manual to help you select a graph's proper line attributes and markers (which must be entered with nu-

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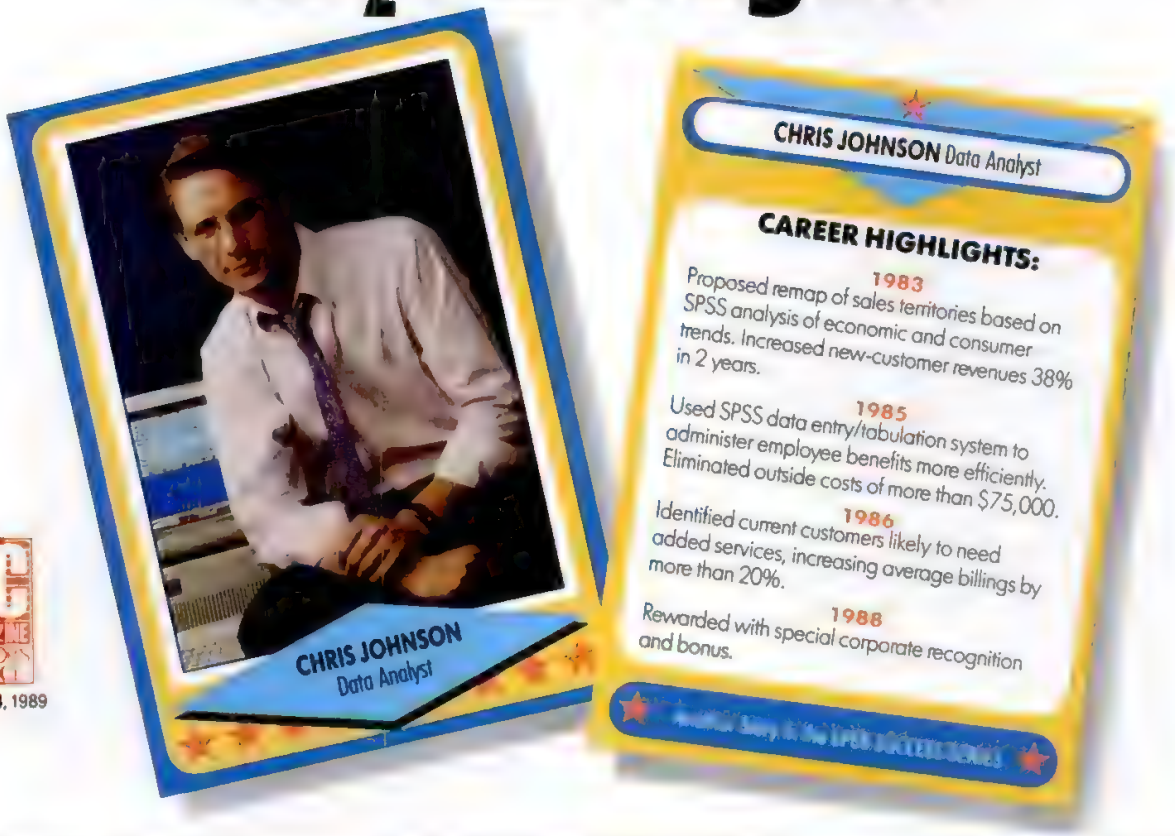

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March 14, 1989

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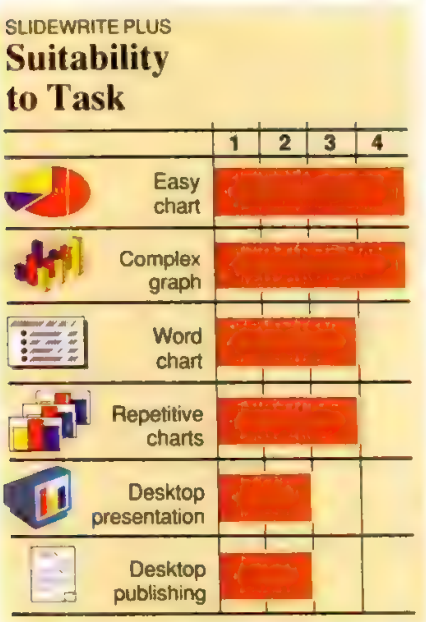
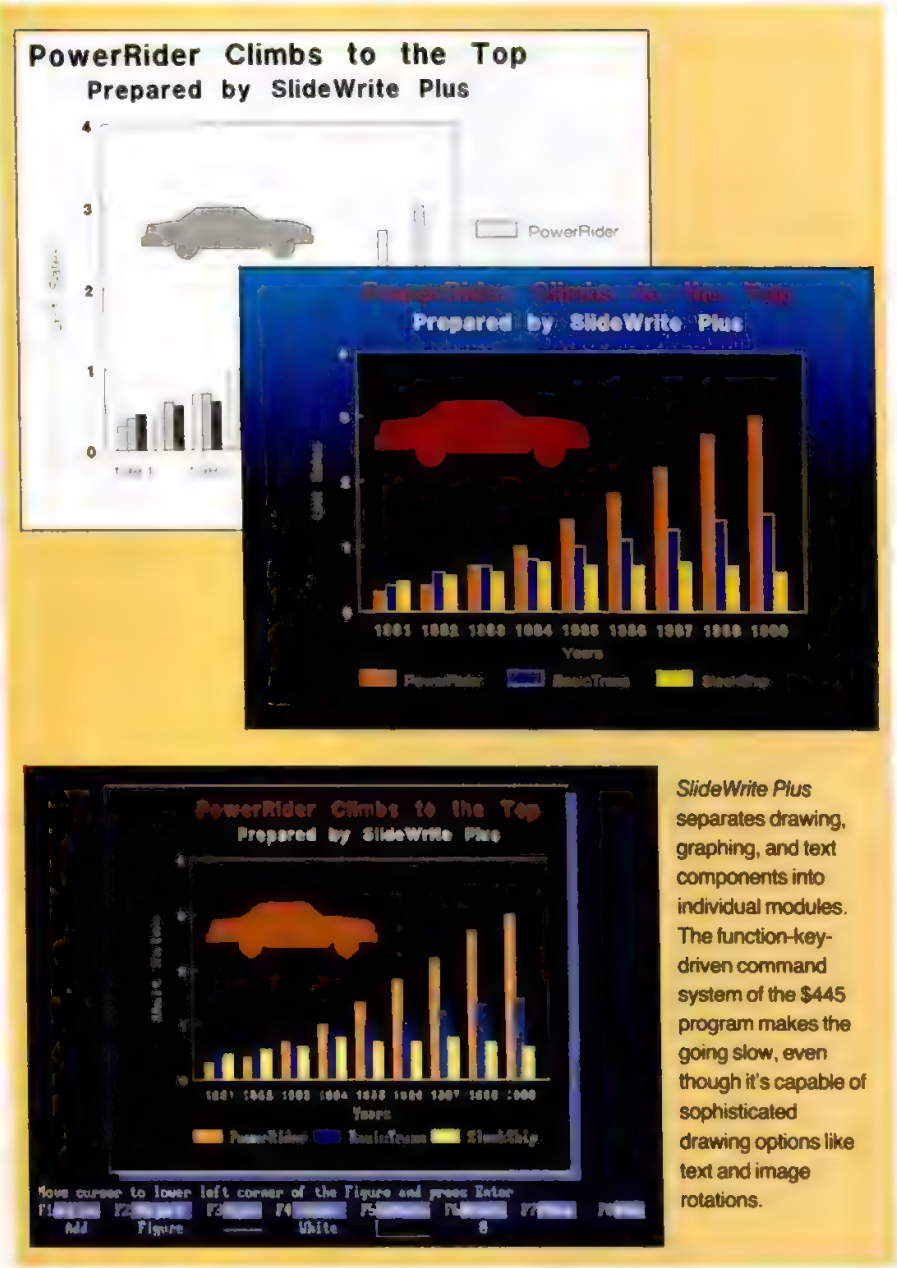
meric codes), neither module suffers terribly from the "design-by-forms" program design.

In the drawing module, the function-key-driven interface is more of an annoyance. You need to press so many function keys that by the time you select "Add-Box-Fill-Line Thickness-Color," for example, you can forget what it was you wanted in the first place. But, if you can live with key presses, *SlideWrite Plus*'s functionality is impressive.

In draw mode, you can add images from the practical, but not dazzling, 421-image clip-art library or import bitmap TIFF and .PCX images with full on-screen display. Unlike most other packages that incorporate imported images into a graphic, in *SlideWrite* the imported images are only referenced in the *SlideWrite* file. As a result, if you import an image from a floppy disk, that disk must be in place each time you call the file. The benefit of this approach is that it's easy to drop in a new logo or image file, since the reference remains the same. The disadvantage is the file-management headache it creates.





SlideWrite Plus separates drawing, graphing, and text components into individual modules. The function-key-driven command system of the $445 program makes the going slow, even though it's capable of sophisticated drawing options like text and image rotations.

The draw function also adds elements differently than in most other packages. They are added as overlays to the underlying text or graph, so if you leave the draw module and reenter the text module to modify something, the drawing is temporarily removed from view. This can make it tedious to align drawings with text or graphs.

The draw module does have its strong points. One of its more-impressive features is its support of spline-based curves. A much more flexible drawing tool than the arc tool found in most of the packages reviewed, this tool can create curves that can be incorporated into both open and closed polygons.

The *SlideWrite* work-area-display screen has a surprisingly quick screen redraw, which can be interrupted at any time by pressing F8. This responsiveness makes the modify-preview operation enjoyable instead of horrific. However, the work area is not true WYSIWYG. You'll see unfilled fonts and a black (or charcoal) background. To see a true WYSIWYG display you must print to the screen, selecting it as the device (this takes three keystrokes).

GRAPHING CAPABILITIES

Charting performance is *SlideWrite*'s linchpin. You can plot up to 4,000 points per graph and as many as 12 data series per chart. You enter (or import via *Lotus 1-2-3* or ASCII) data into an attractive on-screen worksheet and select from seven basic graph types to display. In addition to a plethora of what have become standard chart enhancements (including a dual *y*-axis option) the package offers a wealth of

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scientifically oriented charting options.

Besides offering many variations on all important curve fitting—linear, log, exponential, spline, and polynomial fits from first to sixth order—*SlideWrite*'s scientifically directed features even let you type in an equation such as y=f(x) and have the equation graphed. A summary statistics screen provides summary information, including standard deviation. The Greek and Math fonts built into the program should tell you something about the intended audience. The clip-art library is not especially exciting, but there are plenty of scientific and technical icons, including chemical, electrical, and flowchart symbols. However, the clip art cannot be pulled apart and modified the way it can in many other programs.

PC MAGAZINE FACT FILE

***SlideWrite Plus*,**
Version 3.1
Advanced Graphics Software, Inc., 333 W. Maude Ave., #105, Sunnyvale, CA 94086; (408) 749-8020.
List Price: $445 (a free demo version is available).
Requires: 390K RAM, DOS 2.0 or later. Hard disk drive recommended.
In Short: Based on a somewhat tedious function-key-driven menu system, *SlideWrite Plus* shines when it comes to charting, especially for scientific data. The program offers simple-to-use but fairly sophisticated drawing and text-charting capabilities.

CIRCLE 401 ON READER SERVICE CARD

Another offbeat aspect of this program is the way it handles text sizing. Instead of entering a point size, you simply select Giant, Large, Medium, Small, or Tiny. The method to the madness is that there's a relational arrangement between these sizes. If the appointed size text is too large to fit on-screen, you select the Shrink command. The command actually reduces the size and maintains the relationship between all of the sizes on the page. Each Shrink reduces the text size by about 20 percent, and each Expand does the reverse. It seems rather coarse, but time after time this sort of trial-and-error approach produced the desired results.

EXPORT AND OUTPUT

SlideWrite can export a wealth of file formats, making it a top contender for the presenter who flits from medium to medium. The program also has impressive support for a variety of high-end output devices, including all the major film recorders and PostScript printers. You can install only one plotter, one printer, and one film recorder at a time, but changing the configuration is easy. Some film recorders, including the Matrix, are supported as plotters.

One area where the program really falls down, however, is in its slide-show facility. The primitive feature essentially enables you to create a batch file that is printed to the screen. A Batch Print Form asks you to supply the name of the file you want to include, but there is no facility to retrieve a list of files or to mark a list of files. There are no special transitional effects between images, although you can manually or automatically advance between images and go backward image by image. The same Batch Print Form handles the automated printing of as many as 45 charts to the selected output device, camera, plotter, or printer.

User satisfaction with *SlideWrite Plus* is high—by some estimates it is tied with the highly publicized *Harvard Graphics* for first place. *SlideWrite Plus* scored high marks for ease of use, training, and documentation (the irony is that the program has no on-line help). I suspect that as programs with graphical user interfaces become more entrenched, both *SlideWrite* and *Harvard Graphics* will lose ground. But for now, *SlideWrite Plus* is a solid performer that runs on any PC configuration (including floppy disk systems) and sails past the others when it comes to scientific data.

Xerox Presents

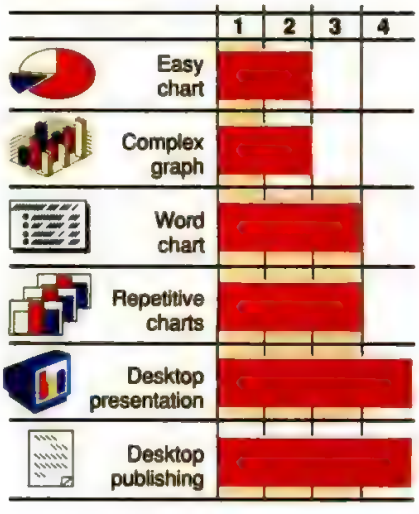
by Robin Raskin

Indisputably the most ambitious presentation graphics package available for MS-DOS users, *Xerox Presents* heralds a new generation of presentation software—one based entirely on a graphical user interface, where the emphasis is on the show as a complete entity. Unfortunately, the *Windows*-based, totally WYSIWYG, dialog-box-laden interface of the $495 program can be maddeningly slow, cumbersome, and confusing, even on a 386-based machine.

Perhaps Xerox tried to be too faithful to Cricket Software's ground-breaking *Cricket Presents*. . .when it reworked the program for the PC. To do what the Mac does, *Xerox Presents* needs Bitstream fonts, 1MB of memory, and if you're smart, a 386 machine. Even with all that overhead, what seems fluid on the Mac seems circuitous and poky on a PC.

Presents's emphasis on the presentation gestalt is immediately obvious. Rather than designing a single image at a time,

XEROX PRESENTS
Suitability to Task



you work with a series of frames, stored as a single presentation (the default is five frames to a file).

Immediately, you're forced to think about the look of the presentation. You assign an output device, which adjusts the aspect ratio of your on-screen work area. You apply a background color or template to the frames in one swoop, creating consistent-looking elements.

Once the background is defined, the next item on the agenda is to apply a "page style"—one of over 200 predefined templates—to an individual frame. Page styles offer exemplary device-specific layout, font, color, and size information. So, for example, if you are designing for the screen, you'd poke into the STYLSCRN page style directory.

The biggest disappointment with this strategy is that a page style such as "CNBAR1" (a simple centered bar chart) is repeated as a separate template in each of *Presents*'s device-dependent page styles. When it gets right down to it, the number of style sheets per device is fairly limited,

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June 13, 1989

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SUPER CARTRIDGE 2, *"Editor's Choice"* ($699)

—PC Magazine, June 13, 1989

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—PC Magazine, January 17, 1989

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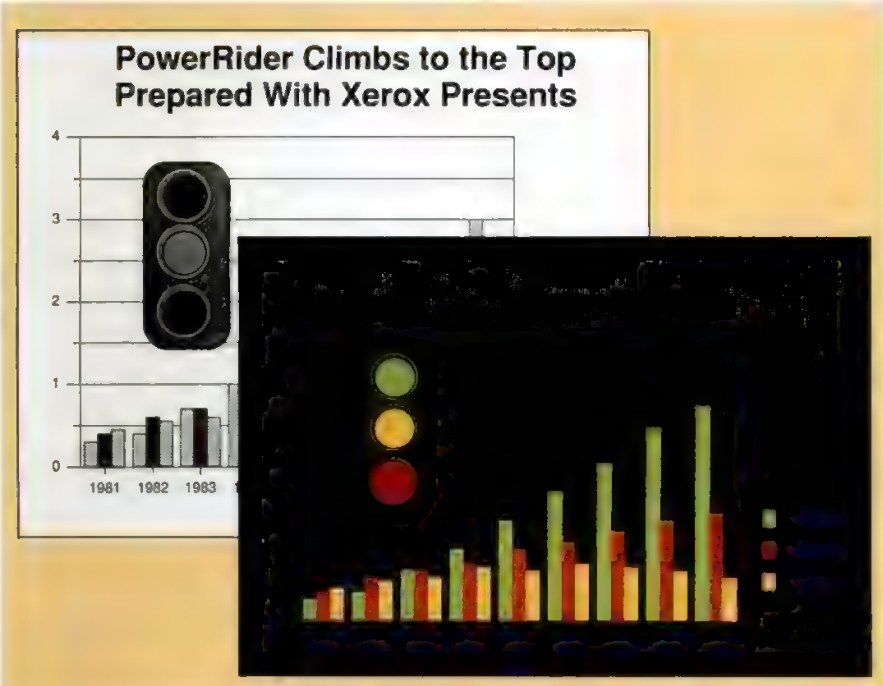
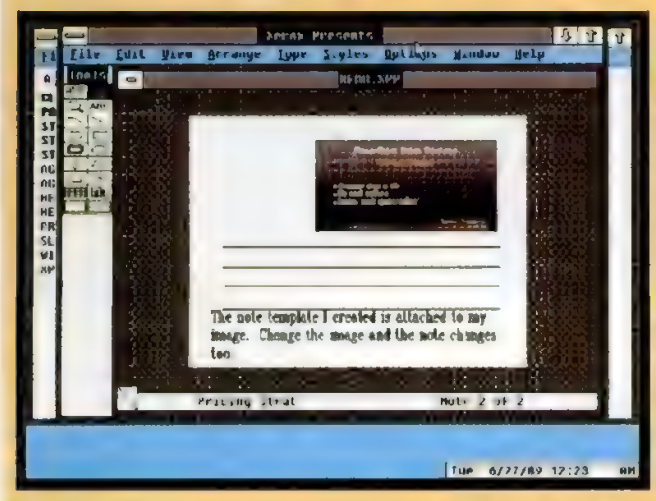




Xerox Presents, Xerox's $495 version of the Macintosh-based *Cricket Presents* program, makes the accoutrements of the presentation trade part of the production process. Each frame in a presentation can have associated notes and handouts. A note page includes a thumbnail sketch of the image.

and the types of page styles included are mundane. However, because the style sheets appear in a small window, with attached notes on how to use them, working with them is very easy.

The single, *Windows*-style command line handles many of the editing and file functions. All drawing, graphing, and table-creation is invoked via a toolbox that runs alongside the frame window.

LIMITATIONS

On the surface, *Presents*'s extensive toolbox seems sufficient, at times even outstanding. It contains a text tool, a table-making tool, a zoom tool, and even unusual graphics primitives such as diamonds and parallelograms. But the limitations soon become obvious.

The most noticeable limitations are in the graphing tool. It's limited to graphing six series of data in only eight of the most rudimentary chart types. When I tried to import the PC Labs test data from a *Lotus 1-2-3* spreadsheet, it simply truncated the data and left no warning message. When I went into the worksheet area and tried to flip my rows and columns to accommodate my data series, I found no such feature. And you can't override the package's automatic axis scaling. Additionally, the options for enhancing a graph are strait-jacketed. Xerox offers a more robust companion tool, the newly announced *Xerox Graph*, to offset *Xerox Presents*'s shortcomings, but it costs an additional $295.

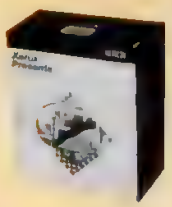
The text-editing tool is exasperating for different reasons. You work with text by selecting the text icon from the toolbox and drawing a box delineating where you want the text to sit on-screen. Immediately, a true WYSIWYG mini-word-processor, replete with search-and-replace functions, pops up into view. The word processor, which displays true fonts, point sizes, and color as you type, is unbearably slow, especially when editing text.

Because *Xerox Presents* is so fully WYSIWYG, the screen redraw times are excruciatingly slow and all-too frequent. A wise addition to the program would be an option that lets you disable the screen redraw until you complete your editing changes.

But the most exasperating thing about the program is also the most exciting thing. You have the ability to optimize output for a particular device. If you select the HP LaserJet as the output device, the page styles and all selectable fonts correspond to that device. This works like a dream, unless, like many presenters, you routinely use a number of output devices.

For example, I created a stunning set of frames designed for screen output. Thinking I'd quickly create some slides as well, I changed the output device to Xerox's slide service, Autographix. Since Autographix does not support Xerox's Bitstream fonts, my 24-point Bitstream Dutch fonts that looked so nice moments ago became microscopic when I changed the output device. I needed to totally redesign each

PC FACT FILE



***Xerox Presents*, Version 1.0**
Xerox Desktop Software, 9745 Business Park Ave., San Diego, CA 42131; (800) 822-8221.
List Price: $495
Requires: 640K RAM (1MB recommended); IBM AT, PS/2, or compatible; *Windows* 2.1 or later; mouse; hard disk drive; EGA, VGA, or Hercules Graphics display; DOS 3.1 or later.
In Short: The PC *Windows* version of the Macintosh hit, *Cricket Presents* What was fluid on the Mac is a bit sluggish on the PC, but nonetheless *Xerox Presents* has everything the presenter needs in one package.

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russian technology of programming

TECHNOLOGY

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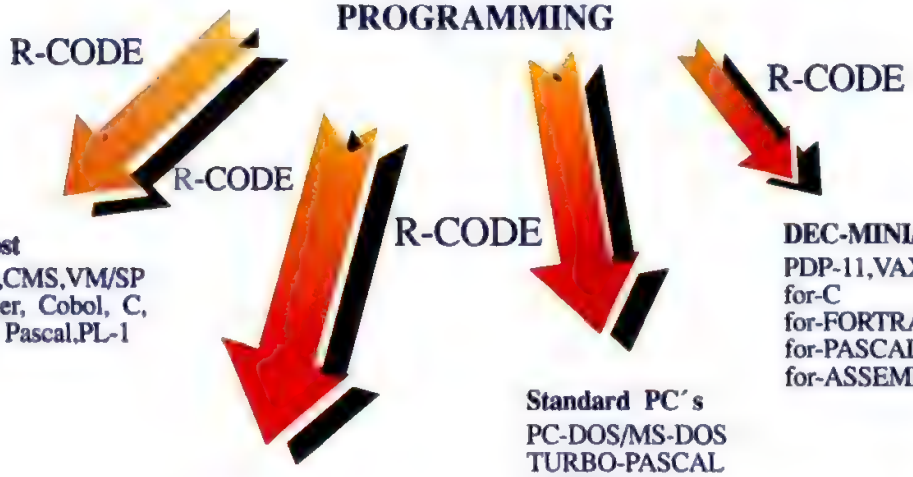

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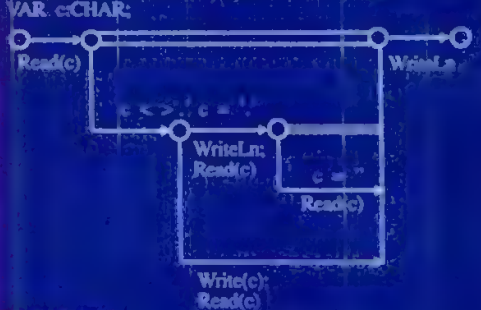
Example of graphic Modula - 2 program



And the same program in traditional form

```
MODULE Printid;
FROM InOut IMPORT Read,Write,WriteLn;
VAR c:CHAR;
BEGIN
  Read(c);
  WHILE c <> '.' DO
    IF c=' ' THEN
      WriteLn;
      Read(c);
      WHILE c=' ' DO
        Read(c)
      END;
    ELSE
      Write(c);
      Read(c)
    END;
  END;
  WriteLn
END Printid.
```

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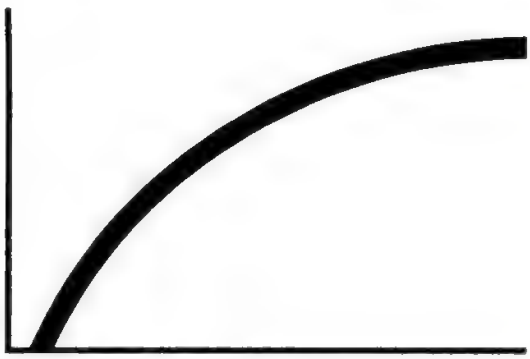

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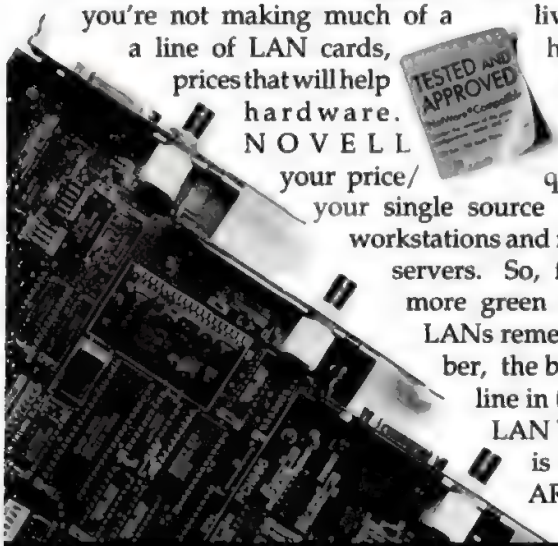

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EDITOR'S CHOICE

Wait and see

None of these PC presentation packages is what we'd hoped for, given the quality of Macintosh-based packages. By year's end, however, we expect to see products that'll merit Editor's Choice as presentation graphics tools.

Of the seven packages we reviewed, Version 3.0 of *Lotus Freelance Plus* is certainly the most improved. The new version does an admirable job of patching *Freelance*'s nongraphical user interface by incorporating intelligent pop-up style boxes and menus. The package's new screen-show facility is outstanding, and its ability to create runtime disk presentations that can be played on any DOS-based machine is unprecedented on the PC. Still, there's room for improvement. Its 508K size makes it impossible to run even the smallest TSR alongside it (a smaller version (438K) is promised). And its user interface is still a far cry from state of the art.

Harvard Graphics is still the package of choice if ease of use is what you're looking for. But although it is probably the best-balanced personal computer–based offering and excels at creating all manner of graphs, our longtime favorite's draw module drags it down. And *Graph Plus* still isn't as easy to use as its *Microsoft Windows* interface would lead you to expect. It's great for graph creation, drawing, and annotation, but it really needs help in the area of word charting.

Our counsel is to keep your eyes pealed for PC ports of the Macintosh giants, Aldus's *Persuasion* and Microsoft's *PowerPoint*, as well as for a long-awaited upgrade of *Harvard Graphics*.

screen for the new output device.

Even a simple change in font size is a big deal in *Xerox Presents*. I had tc click on and reassign every piece of text in the frame by answering the replete series (often as many as seven) of dialog boxes.

Aw . . . What the Heck!

EXTREMELY POWERFUL

DesignCAD 3-D version 2.0 is as powerful as most CAD systems costing $5000 - $10,000! Features like: Complex Extrusions-linear, scaler, and circular, Blending of Surfaces, Shading, Cross Sectioning, Complex Sweeps and Translations, and Boolean operations make DesignCAD 3-D one of the most powerful 3-D CAD systems available . . . at any price! Engineers, Architects and Consultants constantly tell us that they use CAD systems costing thousands of dollars which are not as powerful as DesignCAD 3-D.

VERY EASY TO USE

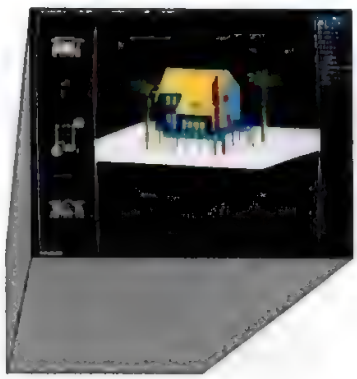
Just because DesignCAD 3-D is powerful doesn't mean it is difficult to use. Single keystroke commands and side-bar menus which give short directions on how to proceed make DesignCAD 3-D a snap to use! While not required, DesignCAD 3-D supports all popular digitizers and mice.

Many of the older, more cumbersome CAD systems require weeks of training before a user can be productive. DesignCAD 3-D users find they can be producing useful drawings in a matter of minutes! In a recent CAD contest only one contestant was able to match our drawing time. The package sold for $3000.00. The other CAD packages took up to twice as long to perform the same drawing and cost up to $5000.00!

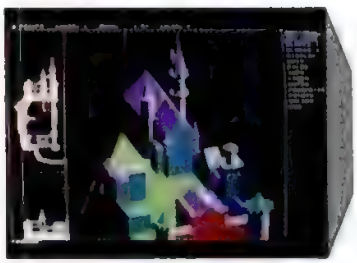
Still don't believe us? The goblet pictured below required only 16 keystrokes and 3 commands to create! The top, front, side, and isometric views were created simultaneously . . . in less than one minute!

VERY LOW PRICED

The first question asked by many people is, "Why is DesignCAD 3-D priced so low?" The answer? After developing DesignCAD 3-D version 2.0, we were unable to decide how the product should be priced. We consulted experts. We used the finest spreadsheets on the market. We took employee polls. Finally, in the great American Tradition, we said, *"Aw . . . What the Heck! Let's see the other guys beat this price!"* DesignCAD 3-D version 2.0 sells for $399.



DesignCAD 3-D only $399!



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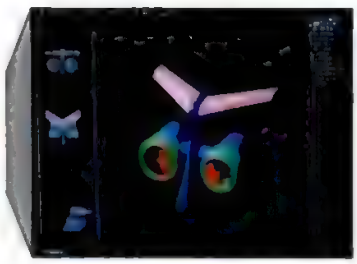
There is a very important reason to buy DesignCAD 3-D. PERFORMANCE. No other CAD system can match our price/performance ratio. Many people make the serious mistake of thinking that it is necessary to spend thousands of dollars to obtain "a good 3-D CAD system." This is not true! We talk to people everyday that are sadly disappointed with their "expensive" CAD systems. Don't be one of them! Call us and we will send you a complete set of literature and a free slide show demo disk. Once you compare DesignCAD 3-D version 2.0 with other CAD systems we know you will choose DesignCAD 3-D.



DON'T TAKE OUR WORD FOR IT

Here is what other people have to say about DesignCAD 3-D:

"After you've worked with DesignCAD, the single keystroke commands are simple to remember and it becomes easy to "flick one key" to execute a command. An extremely ergonomically designed program."

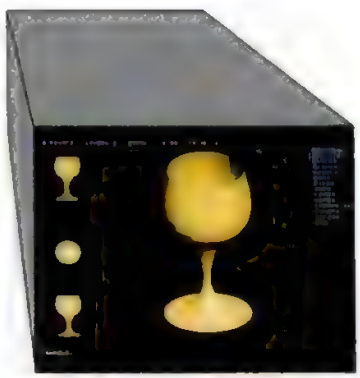
HENRY LEVET, Levet & Daigle Architects - New Orleans, LA
Designed a 65,000 sq. ft. nursing home using DesignCAD

"Recently I worked with a firm that builds decks. They purchased your product on my recommendation. I sat down with them and in two hours they were very proficient in DesignCAD. Now they are more effective; and we can communicate . . . it's wonderful to be able to do a block repeat 42 times and there are 42 2x4's to make the deck!"

J. TURNER, Architect, TAO Ltd. - The Woodlands, Texas

"Allows scientists and engineers to expend minimum time learning and using CAD software so that their time can be expended on the project at hand. It also allows scientists and engineers to quickly present to management all views of a subject. (3-D)."

DR. STEVENS, NASA Space Scientist/Engineer



HOW DO I GET ONE?

DesignCAD 3-D version 2.0 is available from most retail computer stores, or you may order directly from us. DesignCAD 3-D is available in a number of foreign languages from distributors throughout the world. All you need to run DesignCAD 3-D is an IBM PC Compatible and 640K RAM. DesignCAD 3-D supports most graphics cards, printers, plotters and digitizers. Free information and a demo diskette are available by contacting us at:

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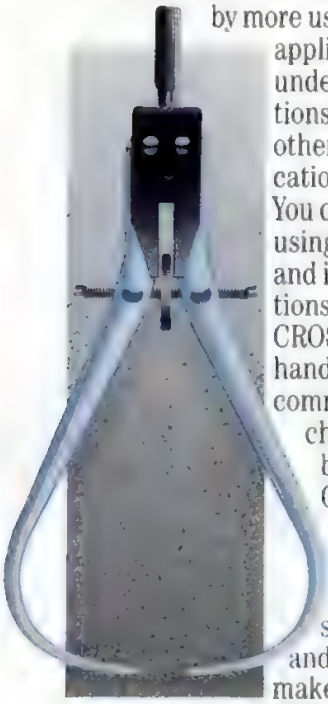

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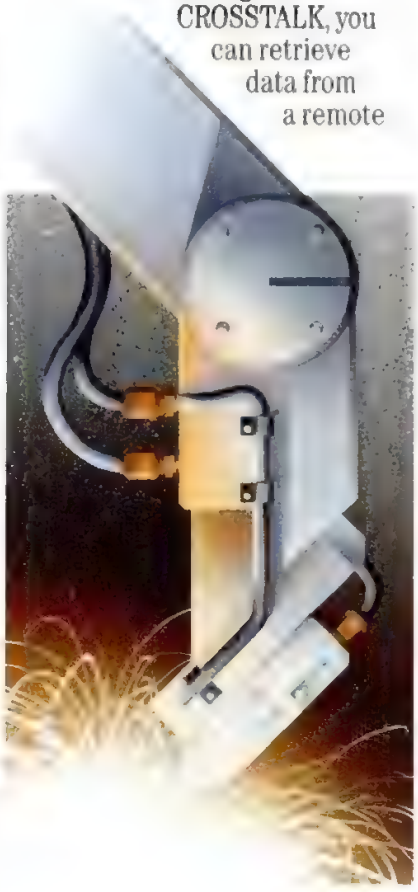

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Again, it was faster to simply keystroke the same information twice. One feature that helps the multimedia presenter is a Sketch mode, which converts color to black-and-white lines (unfortunately, it does not accommodate gray scale.)

PRESENTATION INTEGRATION

If you do a lot of presenting, the presentation-management features may outweigh some of these limitations. Images can be effortlessly converted to helpful speaker's notes (where you can add text comments to a miniature image and print the page) and audience handouts (where you can print multiple images on a page). *Presents* is the only package available for the PC that integrates these adjunct tools so well.

Xerox Presents offers on-screen slide-show features unequaled in other packages, such as the ability to blank the screen, reaccess a slide, and include password protection.

Organizing the elements of a presentation is a cinch, since you can view thumbnail sketches (miniature screens) of each frame in your show and reorganize them by clicking and dragging them to a new place. The on-screen slide-show presentation is attractive and filled with snazzy transitional effects between images. It provides features unequaled in other packages, including the ability to blank the screen, reaccess a slide, and include password protection.

In addition to using *Windows* fonts, *Presents* incorporates Bitstream font technology into the program. You generate and store on-disk the fonts you need from the included Bitstream Fontware Installation Kit. This ensures matching display and printer fonts and is becoming a more and more popular solution to the true-WYSIWYG problem.

There are, as usual, drawbacks that are associated with this seemingly beneficial arrangement. You will need to have ample storage space on your disk; to make all sorts of decisions about character sets, typefaces, and type sizes; and maybe as long as an hour to generate your fonts. Since Bitstream fonts aren't supported by Autographix (the only option for creating slides using the package, because it offers no film-recorder drivers), people who rely predominantly on slides will not be able to use Bitstream fonts with the program.

Despite all this, *Presents* offers the ultimate graphical user interface and can produce some lovely results. But, like so many recent *Windows*-based releases, it's future-oriented (it'll be hot on a 586-based machine). Today, *Xerox Presents* can perform integration and organizational tasks that no other PC program can, but ease-of-use and efficiency of commands are not its strengths. ■

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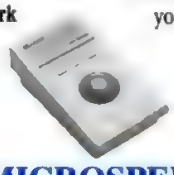

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PC MAGAZINE – May 16, 1989

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Unretouched photograph. Image created on the Samsung SyncMaster multi-scan color monitor.

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PC MAGAZINE—May 16, 1989

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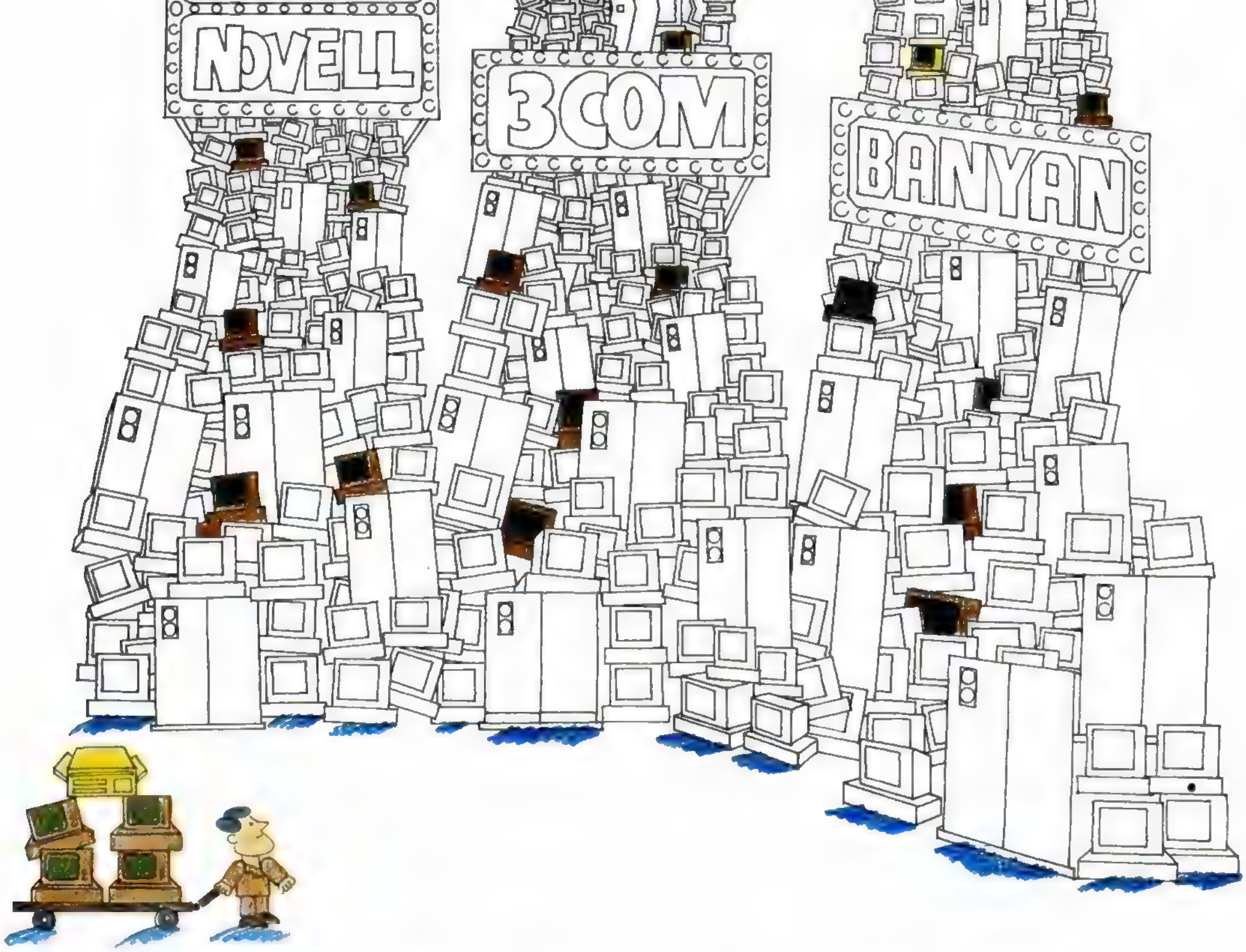

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CIRCLE 230 ON READER SERVICE CARD

PC-BASED CLIP ART

COMPUTER ILLUSTRATION CHARLES CONOVER

INSTANT IMAGES

From business presentations to desktop publishing, clip-art images can be a lifesaver for those who lack the time, money, or talent to create custom artwork.

by Robin Raskin

Even for the best artists, facing a blank canvas is an unnerving experience. But for the growing legion of presenters, writers, and managers who are under pressure to incorporate visuals into their messages, a blank slate can be crippling. Fortunately, electronic clip art is a convenient source of ready-made artwork for your presentations. Like canned soup, canned art all by itself can be pretty bland. But when blended with a smidgen of design sense and spiced up with other software ingredients, it can be transformed into an appetizing recipe.

Clip art is not an invention of the computer age. Graphic artists have relied on stock illustration—volumes of pages of art that could be clipped out with scissors—for years. The electronic version is simply another variation of clip art. Not only can you cut electronic images and paste them into your applications, but you can reuse, resize, crop, rotate, and copy them with considerable ease. When you combine them with drawing and presentation tools, there's no end to the variations you can create.

RESPONSIBLE CLIPPING, OR WHO OWNS THE IMAGE, ANYWAY?

by Robin Raskin and Frederic M. Wilf

The framers of the Constitution should be happy they gave Congress the job of writing the copyright laws. Modern technology keeps racing further ahead of the law, so the task of protecting authors and their intellectual property is considerably more difficult today than it was 200 years ago.

How do you know if your use of clip art—stock or canned illustrations—is infringing upon someone's copyright? Here are some telltale signs:

- Do your presentations look like the Sunday funnies or a visit to Disneyland? If so, you are probably in trouble. Copyright licenses from the likes of Warner Bros., The Walt Disney Co., and LucasFilms are almost impossible to obtain.
- Do you amass your personal collection by shopping for images on bulletin boards? Again, you may be in trouble. Most bulletin board sysops are not aware of copyright law and have not been sufficiently vigilant in policing copyright infringements. On-line images of Cheryl Tiegs or Playboy bunnies are probably not provided with the copyright owner's consent.
- Does one of your coworkers approach you, disk in hand, to tell you that your presentations will look much better if you just paste in a few images? If so, your coworker may be sharing his licensed clip-art library with you and violating the use-the-program-on-any-computer-you-own-but-on-no-one-else's type of license agreement.
- Does your company have an internal potpourri of electronic images to be shared among users? Unless the company has a site license agreement with the clip-art vendor, the extra copies may be infringing.

Using any commercially available clip art package is relatively safe compared with stalking the bulletin boards or manning a scanner with wild abandon, but there are still certain precautions you should take.

The cardinal rule? When you use clip art, you are using art that is created and owned by someone else. Obey the owner's rules.

Clip-art packages come in two flavors of copyright. In one, each individual image is copyrighted. In the other, individual images may not be copyrightable, but the collection or "compilation" of images is protected by copyright law. As it happens, the clip-art packages don't specify which type of copyright, individual or compilation, is being applied.

A judgment call on your part may be required. You have to study your image and decide what rubric it is most likely to fall under. If an individual image is obviously created by an artist and is an artistic expression, the image may be individually copyrighted. If the clip art is a collection of simple symbols, elements, or well-known images in the public domain (such as da Vinci's *Mona Lisa*), then the compilation may not be copyrighted.

When there's a copyright on each individual image, you could be infringing on a copyright by making a single copy of one image in the collection. With a compilation copyright, the owner has a copyright on the entire database of images. One image may be copied a million times, but you can't resell the clip-art library.

To complicate matters further, earlier copyright laws specified that a copyright notice should always appear near the copyrighted image. However, because of a change in the law that applies to copies published on or after March 1, 1989, that notice is not required. This puts the onus on the user to be copyright savvy, since the lack of a copyright notice does not mean the image is not copyrighted.

How the copying is performed is another part of the issue. If the clip-art library images are used by many people on one computer, there may not be a copyright infringement. If you send one image or the library over an electronic network, or you copy the disk and give it to a friend, then you are probably violating the copyright. Under the present U.S. Copyright Act, you have the right to make a backup copy and the right to use any program that you license on a single computer that you own. Implied is the idea of "personal use."

Users usually get into problems when clip art is copied for use by other departments within a corporation or to exported file formats for incorporation

Clip art sometimes gets a bad rap—among professional artists, at least—because it is equated with overly recognizable, overused, and trite art. "Using it," says Andrew Bell of the National Association of Desktop Publishers (NADTP), "is like watching the Geraldo Rivera show. Millions of people do it, but few admit to it." But with the addition of improved drawing tools and better scanners, clip-art collections—once chock-full of simplistic, jagged-looking, overused icons—are improving rapidly.

Today, the proverbial pointing fingers, the stick-figure humans, the too-cute cartoons, and the reams of bubbles and balloons are being replaced by sophisticated libraries of complex images. Fueling the generation of more intricate art is the availability of some exciting drawing and illustration programs. Packages such as *Arts & Letters Graphics Editor*, *Corel Draw!*, and *Micrografx Designer*—when placed in the hands of talented artists—yield complicated illustrations filled with curves, shading, and fine details. Generalized potpourris of symbols are giving way to carefully honed volumes for increasingly specialized applications. More and more, the emphasis is shifting to useful images packaged in a useful fashion.

Electronic clip art can be a lifesaver for those who lack the time or artistic talent to create custom artwork (or the money to pay an artist to do it for them). But before you buy, you need know what quality of art and what kind of images you require. You also need to know the application you intend to use it with and the file format you want to work with. And, of course, you must decide how much you're willing to spend.

into other programs. As a user, you should be aware that clip-art vendors offer site licenses. And if the vendors don't offer site licenses, they should. When artwork needs to be shared, it's best to inquire into getting a site license from the vendor.

Generally, once you've licensed or purchased the copyrighted work, you can do just about anything you want with it, except for freely copying, distributing, or selling the images elsewhere. But copyright is only part of the legal equation. The clip-art vendors each have contractual agreements that must be honored.

Shrink-wrap agreements, found on most commercial software, are *contracts of adhesion* that often go above and beyond the copyright law. Contracts of adhesion are generally defined as contracts where one party (the vendor) has more bargaining power than the other. The vendor presents the contract on a take-it-or-leave-it basis. Some states enforce these types of contracts to the letter and some states don't enforce them at all, but most states will enforce the contract if it is reasonable.

Because clip-art images are files, not software programs, it's much more tempting—not to mention easier—to spread the image. You don't need manuals, and there are no complicated install or boot-up procedures. These freedoms make for promiscuous copying.

Some clip-art vendors follow the old shareware creed: you are free to use the images as long as you don't make money off of them. In other words, it's fair game to incorporate their images into the internal newsletter, but not into your ad campaign or the label for your new product.

Electronic file transfer has made clip-art images easy to pass around. We actually heard from several clip-art vendors who were convinced that another vendor was stealing their images by importing the files. Even if the images are slightly modified, these derivative works may be so close to the original as to have violated the copyright.

The law awards two types of damages for copyright infringement. First, anybody who copies without permission of the owner can be held liable for actual damages if that person suffered monetary losses or other damages. Normally, the actual damages suffered are the lost licensing fees. Second, even if the copyright owner didn't suffer any actual damages, statutory damages may be awarded in lieu of actual damages if the copyright owner had registered the copyright with the Copyright Office in Washington, D.C. before the infringement occured. When statutory damages are available, a judge could punish an infringer by awarding more money than the clip art is worth, especially if the infringer willfully infringed on the copyright. Finally, if the copyright was registered prior to infringement, the judge may also award the copyright owner its attorney's fees and court costs.

You've been warned. ■

Frederic M. Wilf is an attorney who practices computer and copyright law in Media, Pennsylvania.

ART AND SCIENCE

Clip-art libraries are not software packages. They are libraries of graphics available in various formats. Though some collections come with graphics editors that you can use to edit and print images, often there's nothing to boot up and nothing to install. You'd think this would make life easier, but, in fact, using clip art within your applications requires you to have some understanding of file formats.

Commercial clip art is available from the makers of graphics software packages, and competition is mounting as clip art becomes a strategic tool for vendors trying to get their products onto users' desktops. *Harvard Graphics*, *Freelance Plus*, *Micrografx Designer*, and *Arts & Letters Graphics Editor* all have extensive clip-art libraries, and their vendors have staffs of dedicated artists churning out volumes of specialized art. Computer Support Corp. and Micrografx even offer customized clip-art services, so if they don't have what you need, they can create it for you. Version 1.0 of *Corel Draw!* was chided by reviewers for its lack of a bona fide clip-art library. As a quick and inventive remedy, Corel Systems Corp. licensed third-party clip art and now offers a sampler to whet the appetite.

Third-party artists and graphics designers are also getting into the act by producing their own commercial clip art. And why not? Often, such outfits bring a touch of artistry to the marketplace, though with varying degrees of technical finesse. The clip art in *ImageFile*, from Applied Microsystems, an Anchorage, Alaska–based graphics design house, attracted crowds of admirers as it flashed on the monitors at PC Labs, and Rick Barker, a graphics designer by trade, found such strong demand for his *Adobe Illustrator*–generated artwork that he formed a company, Studio Arts, to make it available to others. Dynamic Graphics, a 25-year veteran of the paper-based clip-art business, is now enthusiastically putting its volumes into electronic formats. Most recently, ArtRight Software Corp. pushed the clip-art limits by offering clip art that comes fully colored and loaded with complex Bezier curves that don't break up when enlarged.

While the software vendors tend to sell their clip art in the proprietary formats supported by their own graphics packages, third-party clip-art makers prefer to sell their wares in a variety of standard formats, paying close attention to specialized needs in the market. For example, T/Maker Co. and Multi-Ad Services, two companies with extensive libraries of bitmapped clip art, have recently introduced a series of images in .EPS (Encapsulated PostScript) format. And Marketing Graphics offers its *PicturePak* series in specialized versions for *Lotus Freelance*, *PC Storyboard*, *Show Partner*, and VideoShow, as well as in the more generic .CGM and .PCX formats. *Presentation Task Force*, one of the most-recent market entries, goes one better by offering its free-lance images in both black-and-white and full-color file formats.

It's clear that clip-art vendors are as interested in the medium as the message. And we should be, too.

WORLDS APART

Regardless of who makes it, clip art is available in two general file formats, *bitmapped* and *vector* (or object-oriented). In bitmapped format, the images are composed of a series of dots, created either by retouching images that have been scanned into the PC, or else by drawing them from scratch using a paint package such as *PC Paintbrush*. By contrast, vector-format

files incorporate a description of the elements of an image (lines, arcs, and so on) rather than a dot-by-dot translation.

Bitmapped clip art was the first to appear on the market, and it still dominates. Art in common formats such as .PCX and TIFF tends to be less expensive than vector-format art, and you can edit the images relatively easily by using your paint package to adjust the individual pixels. Although there was a time when the resolution of most bitmapped clip art was a paltry 72 dots per inch, most of the better packages today operate at 300 dpi, the maximum resolution supported by most laser printers.

The bad news about bitmapped clip art is that the number of dots, and therefore the amount of detail, remain fixed when you scale the image. The results can be a jagged-looking drawing if you enlarge the image too much, or a blurred mess if you reduce it too much. And the output resolution is always dependent on the original resolution of the image.

Vector file formats such as PostScript or Computer Graphics Metafile (.CGM) allow greater flexibility because the quality of the image is independent of the resolution of the output device. This means you can change the size and orientation of the image while maintaining the quality of the drawing. It also means that the images are printed at the maximum resolution of the output device.

Encapsulated PostScript (.EPS) is one of the most popular vector formats, especially for clip art aimed at the desktop publishing market. Since most applications don't let you view .EPS images directly on the screen, most clip-art vendors attach a bitmapped version of the image that you can see while you're working. If the vendor doesn't, you'll see nothing but a gray bounding box the height and width of the image. Trying to align this box on a page of text often is difficult, so this is a feature worth looking for. As their name implies, .EPS images were created with PostScript output in mind. While you can bring a PostScript image into *PageMaker* and print the page on a LaserJet or other non-PostScript printer, what you get is simply the bitmapped version of the image.

Outside of desktop publishing, .CGM is the most widely supported vector format, at least in theory. Unfortunately, there are so many varieties of .CGM files that some clip-art vendors won't guarantee that their .CGM formats can be edited, even by graphics applications that claim to support .CGM.

THE THORN IN THE GALLERY

For clip art to be truly useful, you need to be able to access an appropriate image quickly when you need it. But though some vendors make noble attempts at manageability, most clip art comes packaged on numerous floppy disks and relies on a reference book with illustrations of the art. Often, each image is stored in a separate file, and you must reference it either with an obscure filename, an even more obscure number, or a combination of both. When you need an image, you must pull out the reference and start thumbing.

To demonstrate what this means, here are the names of files in which you would find a world map in five of the major clip-art packages:

- In *Micrografx ClipArt*, you'll find the map in WORLD.DRW in the General Clip Art collection.
- In *Click & Clip 500*, which offers a

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Desktop publishing is not only here, it's thriving. Every day, more graphic designers are learning to use computers as tools. However, at the standard resolution of 300 x 300 dpi, most laser-printed output is used primarily for proofing copy. Final copy is still sent to the typesetter.

Like a dream come true, Raster Devices Direct, Inc.™ presents an alternative to type shops: the Trendsetter 1000™.

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wall-size poster of its 500 images as a reference, the map is found in WOR01.EPS.

- In *Arts & Letters*, the map is symbol number 10177, out of a collection of 3,700 images.
- In *Clip3D*, you open the Geography collection, then open the World directory and call for the image GLOB_SLD.SOL.
- In *PicturePak*, the map is in the file called SA0199 (SA stands for Sales and Marketing Edition).

Evidently, you're in for a fair amount of file-flitting when you use electronic clip art. None of these classification systems is terrific. But the feeble naming conventions that DOS supports are much to blame. One of the best attempts to use DOS names effectively comes from 3G Graphics Corp. Instead of the MAN1, MAN2, MAN3 conventions, which don't offer enough information about the image, 3G supplies filenames such as WALKMAN, SITMAN, and RUNMAN, which are a bit more descriptive.

Freelance Plus, *Harvard Graphics*, and the T/Maker collection use a slightly better retrieval scheme, storing groups of images in categorical files. This lets you retrieve and display a file with multiple clip-art images and then isolate the one you need. The problem with this seemingly logical solution is that it is very slow. On the other hand, with these packages, as well as with those from Computer Support Corp. and Micrografx and with T/Maker's *ClickArt Scrapbook+* utility, (see the sidebar "ClickArt Scrapbook+: A Clip-Art Organizer for Windows"), you can create a personal clip-art library. This lets you build up a collection of the images you use most. You can even incorporate images you've created yourself into the file.

But the biggest organizational aid is in the marketing, not technology, of clip art. The increasing use of specialized libraries helps users save money and sanity. Some libraries have an extremely narrow focus; others leave more room for interpretation.

One packaging solution is the "art-of-the-month club." Electronic clip art is being sold by subscription.

MAKING CLIP ART MORE ACCESSIBLE

At the risk of sounding like Andy Rooney—did you ever notice how clip-art titles aren't for sale on the software shelves? How mail-order houses never sponsor clip-art titles? You've almost got to know someone in the business to get hold of the stuff.

Ashton-Tate has an interesting way of letting users know about its clip art. Its new version of *Bylines* will come with sample files from four of the major clip-art vendors. Lotus Development Corp. also plugs its clip-art vendors in its *Lotus Selects* catalog and other publications it circulates.

Another packaging solution is the "art-of-the-month club." Conventional clip art is often sold by subscription, and electron-

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software, they'd be Plus, and Manuscript.

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ic clip-art vendors have followed suit. Dynamic Graphics offers the Designers Club, which for $49.50 per month keeps you supplied with a fresh stock of .EPS images. Studio Advertising Art offers a yearly subscription, mailed quarterly.

Electronic distribution could be a boon for aspiring clip artists. Wouldn't it be nice to pay only for what you clip, letting the vendor take care of the storage problems? But while you can call up just about any bulletin board service in the country and download a pile of images (often of questionable origin), no commercial clip-art vendor has yet announced an on-line service.

The advent of CD-ROM technology should help, however, especially if you use clip art all the time. First on the scene in this format is *Clip3D* from Enabling Technologies, which is available from NEC Home Electronics on CD-ROM, as well as on-disk, as reviewed in this issue. Not wasting a moment, NEC is poised to introduce *Image Folio* (see the sidebar "Clip Art for Realists"), a clip-art library of photographic images, and other vendors are eyeing CD-ROM alternatives. Expect to see more titles as soon as hardware prices take a few more tumbles.

The clip art you choose will say something about you and your style, so get vendors' catalogs and start comparing.

THE PSYCHOLOGY OF CLIP ART

The clip art you choose will say something about you and your style. To determine what's best for you, call vendors, get their catalogs, and start comparing.

You'll need to think about the amount of detail you require in your images. On the one hand, you want enough detail to make sure that the lines meet neatly and the fill patterns and grays are pleasing to look at. Clip art objects generated from scanned images can leave all sorts of dirty, blurry artifacts if they aren't retouched properly. But on the other hand, the more detail the images contain, the more disk space the files take up.

You'll also need to decide whether you can live with the images as they are. Most often, a clip-art image will be almost, but not quite, what you need, and you may want to customize it. If that's the case, you'll want to make sure you have a graphics editing program to do the job, or else make sure that the clip art you order is compatible with the tools you've got.

If your subject is particularly specialized, look for smaller optional libraries designed for your field. If your needs are more general, however, all packages are more or less created equal. We discovered a fair amount of incest in the clip-art community. For example, nearly every package sports its own variation on the cruise ship at sea, the office worker at his computer screen, the pointing finger, and the handshake.

Finally, there is the issue of price. The diversity in distribution, cataloging, and pricing is enormous. Some companies bundle the art in meaningful collections, others go for a hodgepodge package. Some are sold on a subscription basis, others by the disk, and still others as a collection of disks. Collections range from $50 to $500, and when you average it out, you're paying anywhere from pennies to upwards of $2 per image. If you're putting together a community newsletter, bitmapped clip art is less expensive and will usually suffice. But if you're working on the corporate newsletter, you should seriously think about getting higher-quality (and more expensive) .EPS images that you can print on a PostScript printer.

We reviewed 17 clip-art packages. Five of the packages are clip-art libraries created by leading vendors of drawing and presentation packages (*Corel Draw!*, *Freelance*, *Harvard Graphics*, *Arts & Letters*, and *Micrografx*). The other 12 are third-party clip-art packages, created by graphics designers and available in a number of different file formats.

We experienced a clip-art boom during the review process. Each time we thought we'd exhausted the supply, a brand new package would make its way to our door. The newer collections from ArtRight Software, Metro Image Base, and New Vision Technologies are incredibly slick and stylized, especially when compared with the more austere granddaddies of clip art such as *Harvard Graphics* and much of the T/Maker collection.

You may find that clip art changes the way you work, and not always for the better. So, think before you clip.

ArtRight Image Portfolios

by Robert Kendall

ArtRight Software Corp. is a fledgling Canadian company that came into the world on the coattails of compatriot Corel Systems, maker of the hot new graphics package *Corel Draw!* (one of our Editor's choices in our last article on drawing programs, "Fine Lines: The PC as Illustrator," *PC Magazine*, June 27, 1989). Hoping to cash in on the considerable success of *Corel Draw!*, ArtRight has produced a library of color clip art that it offers in Corel's proprietary object-oriented .CDR format, as well as in encapsulated PostScript (.EPS) and .CGM formats.

Volume 1 of *ArtRight*'s two-volume collection was available at review time. This $149 miscellany of 280 images is distinguished by complex naturalistic representations with often remarkable attention to detail. For example, a fish is depicted with each of its scales drawn individually. And different fill patterns often create subtle gradations of shading to mimic light reflected on the surface of objects. The illustrations also put color to excellent use for those with color output devices.

In terms of content, the *ArtRight* library has decided strengths and weaknesses.

***ArtRight Image Portfolios*, Version 1.0**
ArtRight Software Corp., 1130 Morrison Dr., #330, Ottawa, Ontario, Canada K2H 9N6; (613) 820-1000.
List Price: $149
Requires: DOS and hardware requirements depend on graphics package used.
In Short: The first volume in the *ArtRight* clip-art series offers attractive, detailed color images for use within *Corel Draw!* The library is also available in .EPS and .CGM formats.

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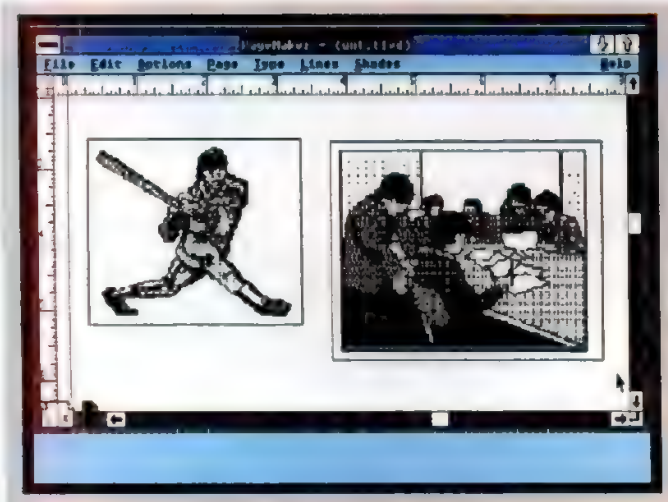


ArtRight Image Portfolio's images may lack stylistic variety, but the images the package does offer are of superior quality. The object-oriented art doesn't look too impressive on-screen, but printouts are crisp and clean.

You get nearly two dozen images of flashy-looking cars and motorcycles. There's a substantial selection of hazard, restriction, and public utility signs. Animals and sports are especially well represented, and there's a good offering of office scenes and corporate paraphernalia, such as computers, desks, a filing cabinet, pens, scissors, and so on.

By contrast, images of money or time are conspicuously absent from the collection (though these will be found in Volume 2, which was unavailable for review). You won't find any of the usual cartoon figures here—a deliberate omission, according to a company representative, to maintain a serious tone for the collection. And apart from those appearing on the signs, there are very few simple, stylized images of the type suitable for logos or pictographs. In general, the collection would benefit from a little more stylistic variety.

Corel Draw! created all the images, and the .EPS files are the product of its file-conversion utility. Thus *ArtRight* files can't be edited from within programs such as *Adobe Illustrator*, since *Corel*'s .EPS format is incompatible with *Adobe*'s. Furthermore, *Corel*'s .EPS filter converts colors to shades of gray. ArtRight says, however, that future releases of its .EPS version will be compatible with *Adobe* and in full color.

You can use most of the images as is, but a few require editing and will therefore have value only to users of *Corel Draw!*. Collections of arrows and crosses are crowded together in a few files, so you must extract the object you want. Conversely, different parts of PCs appear in separate files, so if you want a complete system, you must match keyboard, system unit, and monitor. (In some cases clever cropping with a desktop publishing package can accomplish this, but the process is awkward.)

ArtRight failed to provide us with .EPS files in time for our testing. So using *Corel Draw!*, we converted the .CDR files that ArtRight had furnished, producing .EPS files theoretically identical to the ones the company ships. When we printed these out with *PageMaker*, the results were clear and well defined.

The *ArtRight* library comes with a carefully organized catalog, and most files bear logical, descriptive filenames. Unfortunately, there's no indication of which files are on which floppy disk, making it difficult to call up the pictures from floppies.

If you're willing to give up over 3.5MB of hard disk space, an installation program will create a subdirectory under *Microsoft Windows* and copy all the clip-art files into it. Although the install program we originally received wouldn't run, the vendor sent a revised version that worked but would crash without even loading if *Windows* were in any directory other than C:\WINDOWS.

Volume 2 of the *ArtRight* collection should be available in October, providing clip art to complement Volume 1. The company also plans to issue thematic collections, which you can pick up separately or purchase at a discount on a monthly subscription basis. Projected themes include finance, machinery, medicine, food, flags, and borders.

By supplying .CDR-format clip art, ArtRight is hoping to carve a niche for itself among users of *Corel Draw!*. Its richly detailed color images, well-organized catalog, and reasonable pricing will certainly endear it to many.

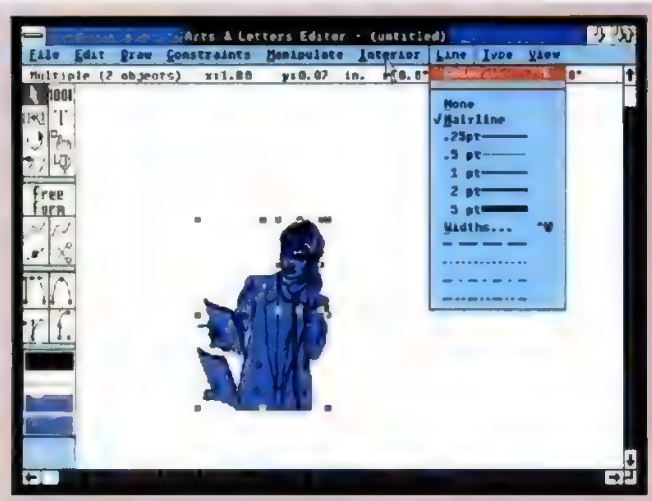
Arts & Letters Graphics Editor

by Robin Raskin

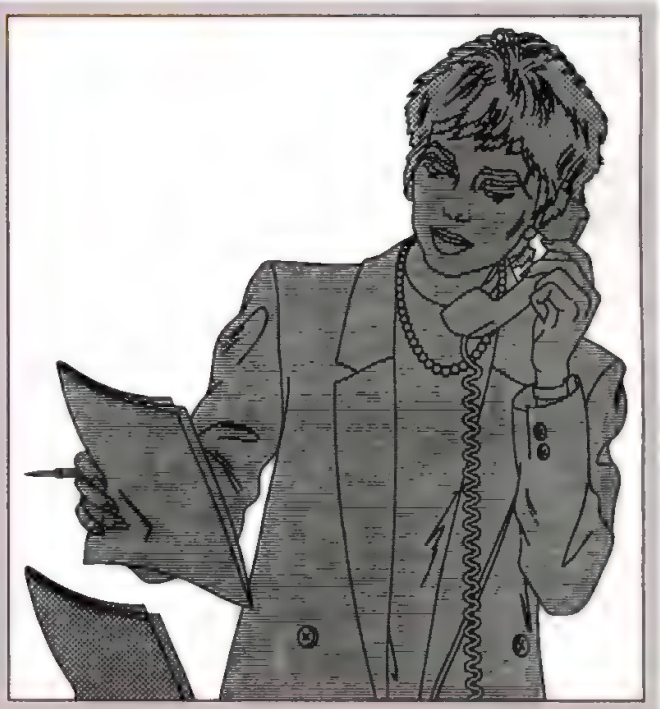
Depending upon who is holding the mouse, the *Arts & Letters Graphics Editor* from Computer Support Corp. is an equally accomplished drawing tool, clip-art generator, and font foundry. More than a clip-art library, *Arts & Letters* is a one-stop solution for all of your drawing needs. The $695 package includes top-notch drawing tools, over 3,700 color clip-art images, and 46 proprietary typefaces. The clip art and fonts alone make this a solid package, but the drawing features put it over the top.

EDITING POWER

The *Arts & Letters Graphics Editor* operates in the *Windows* environment, whose pull-down menus, scroll bars, and dialog



The *Arts & Letters* object-oriented symbols are made up of a combination of separate elements. You can use the *Graphics Editor*'s powerful align command to snap the basic shape and the accents into a coherent whole. The images appear in a striking blue on-screen, but to maximize their appearance on a black-and-white printer, you must manually recolor them in shades of gray.

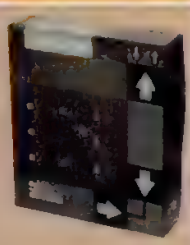


boxes make the screen invitingly familiar. The program is self-installing and takes full advantage of *Windows* features, such as the clipboard and multitasking. It operates expeditiously in 640K of memory, an asset that few graphics programs can boast. Considering how sluggish *Windows* applications can be, the program's speed is impressive. Even as the screen is redrawing, you can pull down a menu and begin working on the next set of commands.

With the *Arts & Letters Graphics Editor*'s image-sizing and rotation tools, its palette of 16 million colors, and its Bezier-curve-drawing facilities, creating a custom image is a cinch. All of the company's clip-art images can be converted into their component lines and curves for editing. Only a few of the symbols gave trouble in manipulation, perhaps because they were ported over from the company's older clip-art package, *Diagraph*.

The toolbox's zoom, alignment, symbol grouping, foreground and background, and snap-to-grid features are precision instruments—a match for any top-of-the-line drawing package. The program's distribution feature creates graded backgrounds, three-dimensional and other special effects, and shading. Because typefaces are treated as graphic elements, you can rotate and mirror words as well as images. If you prefer to scan in your art, you can use *Arts & Letters* to trace and convert mapped images into a more usable format.

Getting an image out of the *Arts and Letters* proprietary .GED format and into another application is a piece of cake. We cut-and-pasted with the *Windows* clipboard and exported files into the .EPS and .CGM formats without problems.



***Arts & Letters Graphics Editor*, Version 2.0**
Computer Support Corp., 15926 Midway Rd., Dallas, TX 75244; (214) 661-8960.
List Price: *Arts & Letters Graphics Editor*, $695; *Arts & Letters Composer*, $395; clip-art libraries, $59 to $120.
Requires: 640K RAM, hard disk, *Microsoft Windows* 2.0 or later, DOS 2.0 or later; graphics card, pointing device, and printer supported by *Windows*. Mouse strongly recommended.
In Short: In addition to being a full-bodied illustration program, the *Arts & Letters Graphics Editor* offers a rousing 3,700 clip-art symbols and 46 typefaces. Twenty-two additional specialty libraries make this one of the largest collections available. Drawing tools are particularly noteworthy. The numerically indexed hard-copy reference is workable, but not an especially pleasant image-management solution.

CIRCLE 404 ON READER SERVICE CARD

BROAD SCOPE

On a scale of one to ten, the clip-art collection rates a score of eight or nine for style and comprehensiveness. The art ranges from simple adornments such as stars, floral patterns, page borders, and optical designs all the way to highly stylized, fully rendered pictures. The subject matter is wide-ranging, including appliances, body parts, clothing, currencies, maps, seasons, transportation, and industry, to name a few. There are banners and boxes, arrows and word balloons. There are attractive icons. There's a collection of charting aids to help you create flowcharts, organization charts, office layouts, and data charts. The collection strikes a good balance: no single category is exhausted, but none is left untouched.

Version 2.0 of *Arts & Letters*, just released this spring, adds a bevy of features to entice the drawing/illustration crowd. These include more import and export capabilities, calligraphic pens, and nifty effects. For example, an image hole-cutter lets you see through images to what's behind them, and text can be curved along a path. In addition, it has added spot- and color-separation capabilities and support for the Matrix film recorder, which makes *Arts & Letters* a fine choice regardless of output media.

But for retrieving images, the *Arts &*

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- Alaska, Hawaii, outside continental U.S., APO/FPO call for information

*Defective software replaced immediately. Hardware replaced or repaired at our discretion

Item availability and price subject to change without notice

Software is not copy protected, except where marked by asterisk

CONTEST RULES **1.** Entries must be received on or before 1/31/90 **2.** Winner selected in random drawing by attorneys for Micro Warehouse Inc. (MWH) whose decisions are final **3.** Prize subject to availability. MWH reserves the right to substitute wholesale cash value up to $5,000 **4.** Winner responsible for taxes. **5.** Odds of winning depend on number of entries. **6.** MWH will announce the winner on or around 2/28/90. Winner will be notified by mail. Dates subject to change at the discretion of MWH. If unable to contact any winner, an alternate will be selected by random drawing. **7.** Contest is open to US residents, except where prohibited by law. Employees of MWH and suppliers not eligible. **8.** Prize - one Compaq SLT 286 w/640K RAM and 40Mb Hard Drive

MODEMS & FAX BOARDS

GVC Chenel
Mini Modem 2400bd AC/DC ..... 157.
Practical Peripherals
Modem 2400SA Ext ..... 174.
PM2400 MNP/Lvl 5 (Int) ..... 174.
Quadram
JT Fax Board 9600bd Int ..... 585.
JT Fax Portable ..... 350.
The Complete PC
The Complete Fax 4800bd ..... 249.

MONITORS

NEC
Monitor Multisync 2A ..... 495.
Monitor Multisync 3D ..... 659.
Monitor Multisync GS ..... 219.
Princeton Graphics
Ultra-14 VGA ..... 539.
Zenith
ZCM 1490 14" Flat Screen ..... 579.

PRINTERS & CARTRIDGES

Citizen
120D and 180D ..... 142/159.
Pacific Data Products
25 Cartridges in One! ..... 283.
Pacific Page ..... New
Plotter in a Cartridge ..... 255.
Panasonic
KX-P1124 Dot Matrix ..... 329.

CLIP ART FOR REALISTS

by Robin Raskin

Clip *photography* is not a wish-list item, it's an option—and NEC Home Electronics offers it. Taking the lead in this new turf, NEC has created *Image Folio*, a collection of over 4,000 VGA-quality photographic images, plus the tools to manipulate them. In another pacesetting move, NEC is packaging this high-resolution photo album on CD-ROM. CD-ROM is the obvious medium of choice for large image libraries, and NEC has made an intelligent move by placing volumes of both rendered clip art and photo images on CD-ROM.

The images, captured from photographs, are rich and robust. Manipulation tools include air-brushing, rotation, cropping, annotation, and lighting effects. The tools are so extensive that the actual photo may become simply the inspiration for custom creations of your own.

The brain behind the pictures is *Image Folio*'s database. Keyword search techniques let you retrieve an image or a group of images. Sample search words include "musical instruments," "woman," or "alcohol." Multiple-keyword searches can unearth a woman/brunette/close-up, for example. You can also use identification numbers or colors to facilitate your search.

As many as nine images can be viewed on-screen at once. The most noticeable and disturbing oddity about the program's display is that luscious 256-color VGA images are accompanied by CGA-type low-resolution text. That's because of the tradeoff between the number of colors and the level of resolution: as one increases the other decreases.

Doing anything utilitarian with the images involves an export function. To insert an image into a document you can choose between the gray-scale TIFF format or the color .WIN (TrueVision File) format. With these two export formats you can produce desktop-published materials, color hard copy, or 35mm slides.

Image Folio presents an interesting marketing dilemma. The images are intended for use in internal documents: newsletters, reports, presentations, and mock-ups. For commercial use, and to acquire higher-resolution original photography, you must contact the source supplier for a particular image. The *Image Folio* database includes information regarding the owner of the image, and the onus is on you to obtain the proper license and rights. ■

FACT FILE

***Image Folio*, Version 1.0**
NEC Home Electronics, Computer Products Div., 1255 Michael Dr., Wood Dale, IL 60191-1094; (312) 860-9500.
List Price: $399
Requires: 640K RAM, VGA graphics, CD-ROM drive, mouse, DOS 3.1 or later.

CIRCLE 410 ON READER SERVICE CARD

Letters low-tech approach is only tolerable at best. You call up each image by entering a four-digit number, which must have been assigned by a random-number generator. Consequently, you'll want to keep your *Arts & Letters* bible, a hefty book with pictures of all the images, close at hand. The art is organized into four categories: Graphics Aids, Icons & Signs, Pictorials, and Applications, but these do more to indicate the complexity of the artwork than the nature of the subject matter. The collection would be far more useful if references were organized more functionally.

Another potential trouble spot pops up when you try to transfer the color screen images into black-and-white print. The default color for most of the clip-art library is blue, which is a terrible color for mapping to black-and-white output devices. To achieve optimal print results, you must convert each symbol manually, from blue to shades of black. This is a time-consuming process that you will wish had been made automatic.

SMALLER VERSION

If the thought of modifying a piece of artwork terrifies you, the company also offers its clip-art library in a simplified version called the *Arts & Letters Composer*, for $395. Considering its low capabilities, the name is something of a misnomer. The *Composer*'s clip art and fonts can be sized, stretched, flipped, and rotated, but not changed in fundamental design.

Additionally, for the *Arts & Letters Editor*, Computer Support offers a series of 22 specialty clip-art libraries, ranging in price from $59 to $120. All told, the *Arts & Letters* series has over 12,000 modifiable images. In case you're still stuck, the company offers a service that turns your hard-copy art into custom clip-art images. However, since one of the *Editor*'s newest features is an autotrace function that takes scanned art and automatically converts it into an *Arts & Letters* object, many users probably will find they no longer need the service.

While Computer Support's product line may be a bit confusing, the products themselves are crystal clear. If you're serious about your graphics, and don't yet have a graphics editor, this is a fine package that will give you both a solid collection of quality clip art and the power to tailor it to just about any purpose.

Bitfolio Computer Art & Symbols Library

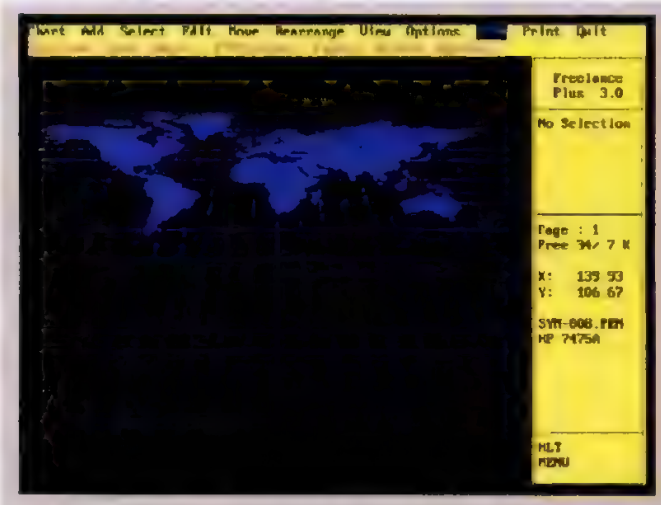
by Bruce Brown

Coddbarrett Associates' *Bitfolio Computer Art & Symbols Library* is a bundle of four series of clip art for use with Lotus's *Freelance* and *Freelance Plus*. The library, which contains over 280 color-image files, costs $295, giving you the symbols in your choice of slide, pen-plotter, or laser printer formats. If you want the other formats as well, extra sets for registered owners cost $50 each.

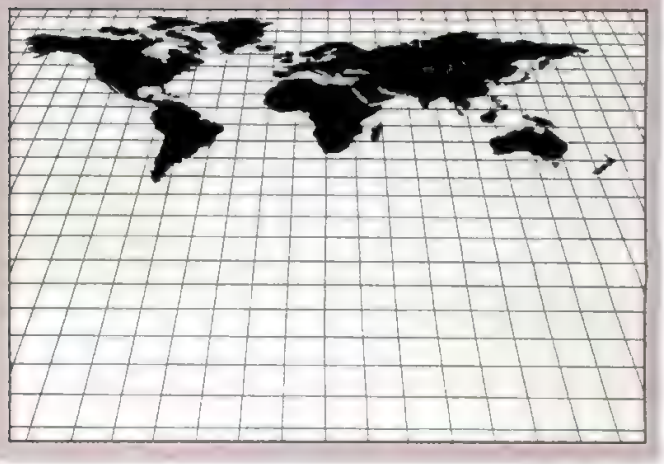
The *Bitfolio* package is an extremely varied collection of complex bitmapped drawings. Like other *Freelance* clip-art packages, the *Bitfolio* collections have no retrieval or output capability of their own—you must bring them into *Freelance* to view or print them. But once you've ported a *Bitfolio* drawing file into *Freelance*, you can easily isolate its elements, saving them as separate files as they are or modifying them to suit your needs.

In this collection, you get a lot more clip art than you may think at first, because many files have multiple images. For example, one file contains profiles of Presidents Washington and Lincoln; another contains five different animals; a third has multiple versions of a single label. Furthermore, many images are composites whose elements can be broken up and used individually; for example, a hand moving a piece on a chess board, or several people sitting around a conference table.

All the *Bitfolio* files come in three versions, one for film recorders and thermal printers (with file extension .SLD), another for laser printers (extension .LAS), and the last for plotters (extension .PEN). You may have to modify them to get them to look their best. The .SLD versions of the *Bitfolio* drawings include a table with suggested colors for the background and various elements in the drawing. Coddbarrett also sells the library in Xenographics format for $149, in pen-plotter version only.



Bring *Bitfolio Computer Art & Symbols Library*'s images into Lotus's *Freelance Plus* and you'll have a great deal of freedom to modify them. With this bitmapped image of the world, you could easily erase the grid lines and isolate a desired portion—South America, for example.



COMPLETE REFERENCE

Bitfolio's user manual doesn't amount to much, but it doesn't have to. Four pages tell you how the files are stored, the color and line defaults in the files, and (briefly) how to add and edit drawings in *Freelance*. The rest of the documentation consists of three file references. One lists all the files alphabetically by specific subject and gives the coded filename for each subject. Two more list the files by subject category and alphabetically by filename, respectively.

The last reference, though, is probably the one you'll use most. It is a printed black-and-white representation of the drawings, grouped by subject matter and listed in order of filename. With the variety and sheer number of files in *Bitfolio*'s collection, it's commendable that the vendor gives you so many ways to find the clip art you want.

Some of the highlights of the collection are its variety of animals and insects, backgrounds, business and finance symbols, realistic drawings, and cartoons of people engaged in various activities, common objects such as gum ball machines and wristwatches, hand shots, human forms, office objects, and sports and recreation images. The *Bitfolio* images don't have the same high degree of realism in detail, shading, and shadowing as do those of some of their competitors, but you may not need or be able to reproduce such highly realistic artwork anyway.

If you're a *Freelance* user, the impressive *Bitfolio* collections are a reasonably priced way to acquire a library of good, though not spectacular clip art. Because many of the images are in multiple parts, you can use them as the initial elements for constructing whatever you need. And of course you can also use them just as they are in your charts and designs.

FACT FILE

Bitfolio Computer Art & Symbols Library
Coddbarrett Associates Inc., 65 Ashburton St., Providence, RI 02904-2608; (800) HIRES-35, (401) 273-9898 in Rhode Island.
List Price: $295 in either laser, slide, or plotter formats; additional formats available for $50 each.
Requires: 640K RAM, hard disk, Lotus's *Freelance Plus* 2.0 or 3.0; DOS 2.0 or later; Hercules, CGA, EGA, VGA, or MCGA video adapter.
In Short: Art of reasonable quality and variety combined with superb documentation make these versatile collections a good starter pack for the *Freelance* crowd. Files optimized for film recorders should be of special interest if you create presentations.

CIRCLE 405 ON READER SERVICE CARD

Click & Clip 500

by Robin Raskin

The trend in third-party clip-art for desktop publishing is epitomized by Studio Advertising Art's *Click & Clip 500*, a 500-image clip-art library that costs $395, and Click & Clip subscription service, which costs $125 per year (or $39.95 for each quarterly issue). Images are stored in Encapsulated PostScript format for use with *PageMaker* and *Ventura Publisher*. The focus on line art and even the style of the images are optimized for PostScript-based desktop publishing, the cream of the DTP crop.

The collection includes strings of text

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- M1MB of 32-Bit RAM expandable to 16MB
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- 2Static RAM
- 2Shadow RAM Option for Video and BIOS
- nincluded
- nIntel 80387-33 and WEITEK 3167 Socket
- 0Dual Floppy/Dual Hard Drive Controller
- wwith 1:1 Interleave
- 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- 9Ports: 1 Serial, 1 Parallel, 1 Game
- 1Clock Calendar with Battery Backup
- 88 Expansion Slots: one 32-Bit,
- ffive 16-Bit, two 8-Bit
- 25 Drive Bays - 3 Exposed, 2 Internal
- S200 Watt ASTEC Power Supply
- 3Enhanced 101-Key Keyboard

Model 325

- Intel 80386-25 CPU running at 25/8 MHz
- **Landmark v1.1=41.8 MHz**
- 1MB of 32-Bit RAM expandable to 16MB
- Intel 82385 Cache Controller with 32KB Static RAM
- Shadow RAM Option for Video and BIOS included
- Intel 80387-25 and WEITEK 3167 Socket
- Dual Floppy/Dual Hard Drive Controller with 1:1 Interleave
- 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Ports: 1 Serial, 1 Parallel, 1 Game
- Clock Calendar with Battery Backup
- 8 Expansion Slots: one 32-Bit, five 16-Bit, two 8-Bit
- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
- Enhanced 101-Key Keyboard

Model 320

- Intel 80386-20 CPU running at 20/8 MHz
- **Landmark v1.1=33.4 MHz**
- 1MB of 32-Bit RAM expandable to 16MB
- Intel 82385 Cache Controller with 32KB Static RAM
- Shadow RAM Option for Video and BIOS included
- Intel 80387-20 and WEITEK 3167 Socket
- Dual Floppy/Dual Hard Drive Controller with 1:1 Interleave
- 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Ports: 1 Serial, 1 Parallel, 1 Game
- Clock Calendar with Battery Backup
- 8 Expansion Slots: one 32-Bit, five 16-Bit, two 8-Bit
- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
- Enhanced 101-Key Keyboard

Model 316

- Intel 80386-16 CPU running at 16/8 MHz
- **Landmark v1.1=20.1 MHz**
- 1MB of 32-Bit RAM expandable to 16MB
- Shadow RAM Option for Video and BIOS included
- Intel 80287-10 Math Co-Processor Socket
- Dual Floppy/Dual Hard Drive Controller with 1:1 Interleave
- 1.2MB 5.25" or 1.44MB 3.5" Floppy Drive
- Ports: 1 Serial, 1 Parallel, 1 Game
- Clock Calendar with Battery Backup
- 8 Expansion Slots: one 32-Bit, five 16-Bit, two 8-Bit
- 5 Drive Bays - 3 Exposed, 2 Internal
- 200 Watt ASTEC Power Supply
- Enhanced 101-Key Keyboard

Model 333
Hard Drive Capacity

Video Combos	60MB	90MB ESDI	150MB ESDI	330MB ESDI
14" MONO	$ 4103	$ 4649	$ 4903	$ 5449
14" EGA	$ 4443	$ 4989	$ 5243	$ 5789
14" VGA	$ 4585	$ 5131	$ 5385	$ 5931

Model 320
Hard Drive Capacity

Video Combos	60MB	90MB ESDI	150MB ESDI	330MB ESDI
14" MONO	$ 2503	$ 3049	$ 3303	$ 3849
14" EGA	$ 2843	$ 3389	$ 3643	$ 4189
14" VGA	$ 2985	$ 3531	$ 3785	$ 4331

Model 325
Hard Drive Capacity

Video Combos	60MB	90MB ESDI	150MB ESDI	330MB ESDI
14" MONO	$ 3103	$ 3649	$ 3903	$ 4449
14" EGA	$ 3443	$ 3989	$ 4243	$ 4789
14" VGA	$ 3585	$ 4131	$ 4385	$ 4931

Model 316
Hard Drive Capacity

Video Combos	60MB	90MB ESDI	150MB ESDI	330MB ESDI
14" MONO	$ 2203	$ 2749	$ 3003	$ 3549
14" EGA	$ 2543	$ 3089	$ 3343	$ 3889
14" VGA	$ 2685	$ 3231	$ 3485	$ 4031

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by Zodiac Technologies

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CIRCLE 319 ON READER SERVICE CARD

CLIP ART: SUMMARY OF FEATURES

(Products are listed in alphabetical order)

GENERAL INFORMATION	ArtRight Image Portfolios	Arts & Letters Graphics Editor	Bitfolio Computer Art & Symbols Library	Click & Clip 500	ClickArt Series	Clip3D Library	Corel Draw!	DeskTop Art
Retrieval software included	○	●	○	○	○	●	●	○
Parent graphics program (used for creating and sometimes for modifying the image)	*Corel Draw!*	*Arts & Letters Graphics Editor*	*Freelance* or *Freelance Plus*	None	None	*Clip3D*	*Corel Draw!*	None
Total number of symbols provided	280	3,700	280	500	2,480	1257	198	Over 1,600
File-naming technique	Descriptive phrases	Code numbers	Descriptive phrases	Descriptive phrases	Descriptive phrases	Descriptive phrases	Descriptive phrases	Code numbers
Symbols handled as objects	●	●	○	●	●	●	●	●
Symbols handled as bit maps	○	○	●	○	●	○	○	●
File formats								
Native format	.CDR	.GED	*Freelance* .DRW	.EPS	.EPS, .PCX	.SOL	.CDR	.EPS, .PCX
Other formats included	.CGM, .EPS	None	None	None	None	None	None	None
File conversion utility	○	●	○	○	●	●	●	○
Conversion formats	.EPS (via *Corel Draw!*)	.CGM, .EPS, .WMF	None	None	.IMG, .MAC, .MSP, .PCX	Micrografx .DRW, .EPS, .PCX, .PIC, .TIF	.EPS, .PCX, .TIF	None
Program can import symbols from a graphics program	○	●	○	○	○	○	●	○
Image modification tools								
Drawing tools	○	●	○	○	○	●	●	○
Editing tools	○	●	○	○	○	●	●	○
Color								
Color images supplied	●	●	○	○	○	●	●	○
Color can be modified	●	●	○	○	○	●	●	○
CLIP ART LIBRARIES								
Printed catalog of clip art	●	●	●	●	●	○	●	●
Can display a list of symbols in library	●	○	○	○	○	○	●	○
Can create user-defined symbol libraries	●	●	○	○	○	●	●	○
Business symbols								
Office	●	●	●	●	●	●	●	●
People	●	●	●	●	●	●	●	●
Landscape	○	●	●	●	●	○	○	●
Buildings	●	●	●	●	●	○	○	●
Transportation	●	●	●	●	●	●	●	●
Industry	●	●	●	●	●	●	●	●
Currency	○	●	●	●	●	●	●	●
Other	Office items	Forms	Banking, financial	None	Logos	Standard messages	None	None
Publishing symbols								
Borders	●	●	●	●	●	●	●	●
Background	○	●	●	○	●	●	○	●
Headlines	○	●	○	●	●	●	○	○
Characters	○	●	○	○	●	●	○	○
Dingbats	○	●	○	○	●	●	○	○
Bullets	○	●	○	○	●	●	○	○
Checks	○	●	○	●	●	●	○	○
Other	None	None	None	None	None	Fonts	None	Writing

●—Yes ○—No

* Special libraries are available for use with Brightbill-Roberts' *Show Partner*, General Parametrics' *VideoShow*, IBM's *Storyboard*, and Lotus's *Freelance*.

Freelance Maps	Harvard Graphics Accessories	ImageFile	Images with Impact	Metro ImageBase	Micrografx ClipArt Libraries	PicturePak	Presentation Task Force	ProArt Professional Art Library
○	●	○	○	○	●	○	○	○
Freelance Plus	*Harvard Graphics*	*Freelance Plus*	None	None	*Graph Draw, Graph Plus,* or *Micrografx Designer*	None	*Freelance Plus*	None
764	684	305	278	1,400	2,865	565	1,700	356
Descriptive phrases	Descriptive phrases	Descriptive phrases	Descriptive phrases	Code numbers	Descriptive phrases	Code numbers	Code numbers	Descriptive phrases
○	●	○	●	○	●	●	●	●
●	○	●	○	●	○	●	○	●
Freelance .DRW	.CHT	*Freelance* .DRW	.EPS	.PCX, .TIF	Micrografx .DRW	.CGM, .PCX	*Freelance* .DRW	.EPS
None	None	None	None	.IMG	None	Various*	.CGM	None
○	○	○	○	○	●	○	○	○
.EPS, .PIC, .SLD, .TIF, .WMF (via *Freelance Plus*)	.CGM, HPGL (via *Harvard Graphics*)	.EPS, .PIC, .SLD, .TIF, .WMF (via *Freelance Plus*)	None	None	.PIC, .WMF	None	*Freelance* .DRW, .DXF, HPGL, .SLD (via *Freelance Plus*)	None
○	●	○	○	○	○	○	○	○
●	●	○	○	○	●	○	○	○
●	●	○	○	○	●	○	○	○
○	●	○	○	○	●	○	●	○
●	●	○	○	○	●	○	●	○
○	●	●	●	●	●	●	●	●
○	○	○	●	○	○	○	○	○
○	●	○	○	●	○	●	●	○
○	●	●	●	●	●	●	●	●
○	●	●	●	●	●	●	●	●
○	●	●	○	●	○	○	○	○
○	●	●	●	●	●	●	●	●
○	●	●	●	●	●	●	●	●
○	●	●	●	●	●	●	●	○
○	●	●	●	●	●	●	●	●
None	None	Financial, teamwork, training	Credit cards, stock market	Stock market	Forms, price tags	Stock market	Organizational charts	Logos
○	●	●	○	●	●	●	●	○
○	○	●	●	●	○	●	●	○
○	○	●	●	○	●	●	○	○
○	○	●	○	○	●	○	●	○
○	○	●	○	○	●	○	●	○
○	○	●	○	○	●	○	●	○
○	●	●	●	○	●	○	●	○
None	None	None	None	None	Banners, cartoon balloons	Writing	Cartoon balloons	None

CONTINUES

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Stanley Steam
Weiner Speci
Soft Drinks
Chips
Pretzels
Get a long little doggie.
FREE KITTENS
Yellow a
CALL
BANANA CAKE
½ cup minus two tablespoons butter
2 cups sifted flour
1 teaspoon baking powder
1 teaspoon soda
1 teaspoon salt
¾ teaspoon salt
1 and 1-3 cup sugar
½ cup buttermilk
1 cup mashed ripe bananas
2 eggs
½ cup coarsely chopped nuts
1 teaspoon vanilla
Stir shortening to
sift in dry ingredie
one-quarter cup bu
and remaining ingr
Cat scan.
Take the cake.
See you later.
Uplifting.
Show boat.
FOR SALE BY OWNE
Raise the roof.
ON-LINE
COMPUTER OPERATOR
Roll over Beethoven.
NLIGHT SONATA
Shoot the moon.
Pick up trucks.
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Lift off.
Let her roll.
Off the wall.
Make amends.
check on this

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LOGITECH

**For IBM PC and compatibles, includes PaintShow Plus. List price for the IBM Micro-Channel version is $399. Catchword is an optional extra for $199.*

CIRCLE 182 ON READER SERVICE CARD

CLIP ART: SUMMARY OF FEATURES

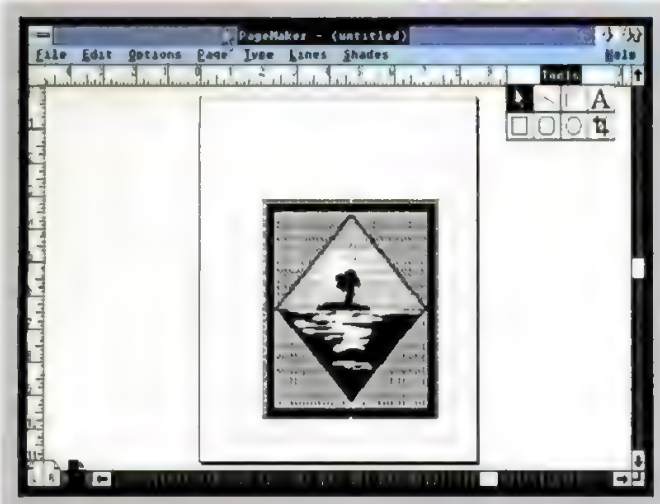
(Products are listed in alphabetical order)

	ArtRight Image Portfolios	Arts & Letters Graphics Editor	Bitfolio Computer Art & Symbols Library	Click & Clip 500	ClickArt Series	Clip3D Library	Corel Draw!	DeskTop Art
Technical symbols								
Flow chart	○	●	○	○	●	●	○	○
Engineering	○	●	○	○	○	●	○	○
Greek alphabet	○	●	○	○	○	○	○	○
Architectural	○	●	○	○	○	●	○	○
Tools and machinery	●	●	●	●	●	●	●	●
Communications	●	●	●	●	●	●	●	○
Computer technology	●	●	●	●	●	●	●	●
Anatomy	○	●	●	○	○	●	○	●
Chemical elements	○	●	○	○	○	●	○	○
Other	Aerospace	Aircraft, chemical processes	Television	None	Aerospace	None	Aerospace, medicine	Medicine
Personal-interest symbols								
Animals	●	●	●	●	●	●	●	●
Nature	●	●	●	●	●	●	○	●
Food	●	●	●	●	●	●	●	●
Sports	●	●	●	●	●	●	○	●
Hobbies	○	●	●	○	●	●	○	●
Furniture	●	●	○	○	○	●	○	●
Appliances	○	●	○	●	●	●	●	○
Musical instruments	○	●	○	●	●	●	●	●
Musical notation	●	●	○	●	●	●	○	●
Other	None	Faces	Common objects, evolution, human forms, presidents	None	Famous people, sculpture	None	None	Ballet, marriage
Miscellaneous								
U.S. maps	○	●	○	●	●	●	●	○
World maps	●	●	○	●	●	●	●	○
Arrows	●	●	○	○	●	●	●	○
Time	○	●	○	●	●	●	●	●
Seasons	○	●	●	●	●	●	○	●
Months	○	●	○	●	●	●	○	○
Holidays	○	●	●	●	●	●	○	●
Military	○	●	●	○	●	○	●	○
Politics	○	●	●	●	●	○	○	●
Elections	○	●	○	●	●	○	○	●
Government	○	●	○	●	●	●	○	●
Cartoons	○	●	●	●	●	●	●	●
Religion	●	●	●	●	●	○	○	●
3-D images	●	●	○	○	●	●	●	●
Other	Road signs and other symbols	None	Hands performing tasks, labels, text	None	None	None	Road signs and other symbols	Education
DOCUMENTATION								
Installation manual	○	○	○	●	●	●	●	○
Tutorial manual	○	●	●	●	●	●	○	○
Reference manual	○	●	●	● (poster)	●	● (poster)	●	●

●—Yes ○—No

Freelance Maps	Harvard Graphics Accessories	ImageFile	Images with Impact	Metro ImageBase	Micrografx ClipArt Libraries	PicturePak	Presentation Task Force	ProArt Professional Art Library
○	●	○	○	○	○	●	○	○
○	○	○	○	○	●	○	○	○
○	●	○	○	○	●	○	○	○
○	●	○	○	○	●	○	○	○
○	●	●	●	●	●	●	●	○
○	●	●	●	●	●	●	●	●
○	●	●	●	●	●	●	●	●
○	○	●	○	○	○	○	○	○
○	●	○	○	○	●	○	○	○
None	None	Medicine	Aerospace, medicine	Aerospace	Aerospace, weather	None	Agriculture	None
○	●	●	●	●	●	●	●	○
○	●	○	○	●	●	●	○	○
○	●	●	●	●	●	●	●	○
○	●	●	●	●	●	●	●	●
○	○	○	○	●	○	●	●	○
○	●	○	○	○	●	○	○	○
○	●	○	○	○	○	○	○	○
○	○	○	○	●	●	●	●	○
○	○	○	○	○	●	●	●	○
None	None	None	None	Children, marriage	Marriage	None	Theater	None
●	●	○	●	○	○	●	●	○
●	●	○	●	○	●	●	●	○
○	●	○	○	○	●	●	●	○
○	●	●	●	●	●	●	●	●
○	○	○	○	●	○	●	○	●
○	●	○	○	○	●	●	○	○
○	○	○	○	●	●	○	○	●
○	○	●	○	●	●	○	●	○
○	●	○	●	○	○	○	●	○
○	○	○	●	○	○	○	●	○
●	●	●	●	○	●	●	●	○
○	●	●	●	●	●	●	●	○
○	○	○	○	●	●	●	●	●
○	●	●	●	●	●	●	●	○
None	None	Education	None	Education	Flags, road signs and other symbols, zodiac	Awards, flags, media	Media, road signs	Road signs and other symbols
●	●	●	○	●	●	○	●	○
○	●	●	○	○	○	○	○	○
●	●	●	●	●	●	●	●	●

ENDS



Many of the *Click & Clip 500* symbols show stylish graphic design, as seen in this tropical image. Much of the finer detail of these object-oriented symbols is lost on-screen; bitmapped representations use messy squiggly lines to depict gray scale.

such as "Bon Appétit," "Newsletter," and "You're Invited," and borders such as blackboards, scrolls, balloons, and other embellishments, making it natural for creating multi-image collages. And if you have greater artistic ambitions, you can use any drawing package that handles .EPS images, such as *Adobe Illustrator* or Aldus's *FreeHand*, to modify them.

Still, you can't help but notice that *Click & Clip*'s object-oriented images tend to be highly stylized, which may not be the look you're after. And while the .EPS format produces handsome output on a PostScript printer, on non-PostScript printers it delivers blurry lines and blotchy fills.

Without a host application, you cannot preview or print the artwork. And even with the host application active, you must retrieve the images one at a time, since each image is stored in its own file. With *PageMaker*, you can view a bitmapped representation of the image in a document. But with *Ventura Publisher*, you aren't so lucky—all you'll see is a gray box that delineates the boundaries of the image.

Because of its reliance on other applications, *Click & Clip* passes the buck with regard to documentation. The package includes only a thin pamphlet, which is heavily slanted toward Macintosh users. Nonetheless this handsome brochure, produced with *Microsoft Word* and *PageMaker*, embellished with *Click & Clip* images, and output on a Linotronic digital typesetter, is a testimonial to the power of the medium.

Click & Clip 500
Studio Advertising Art, P.O. Box 43029, Las Vegas, NV 89116; (800) 453-1860, ext. R641, (702) 641-7041.
List Price: *Click & Clip 500*, $395; *Click & Clip* subscription service, $125 for one year or $39.95 for each quarterly issue; Holidays and International Symbols Special Edition 1.0, $20; U.S. Military 1.1, $149 (additional editions forthcoming).
Requires: Any graphics application that accepts .EPS-format files, PostScript printer. RAM, disk, and DOS requirements depend on graphics package used.
In Short: This sizable library of stylish EPS images makes a nice addition to the PostScript-equipped desktop publisher's workbench. But poor documentation makes it tough to find what you need.

CIRCLE 406 ON READER SERVICE CARD

BY SUBSCRIPTION

You can get *Click & Clip* either by annual subscription or by buying the collection of 500 images. Subscription is a common form of distribution for traditional camera-ready clip art, but this one seems a bit disorganized considering its unbrowsable state. Each subscription houses a potpourri of images, each with a corresponding printout that you can add to a notebook-size binder for future reference. Remembering which image came in which shipment is tough. Each quarterly installment comes with an alphabetized index, but there is no way to get a global listing of all subscription images over the years.

Click & Clip 500, the more useful packaging scheme, comes on 30 alphabetized floppy disks. It even comes with its own storage case. You can load the images on a hard disk, but it may be easier to access each one from its own floppy. This is no problem, since the floppy is clearly marked to indicate which section of the alphabet it contains.

Click & Clip 500 comes with a giant wall-size poster as a reference. The idea is to scan the chart for the perfect image. But the organization is alphabetical, which can be confusing at times.

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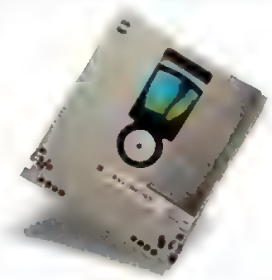

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CIRCLE 161 ON READER SERVICE CARD

CLICKART SCRAPBOOK+: A CLIP-ART ORGANIZER FOR WINDOWS

by Robin Raskin

One of the biggest obstacles to integrating clip art into an application is organizing and retrieving the art. Serious clip-art users can't afford to search through myriad volumes of documentation each time they need an image. They need a system for storing images from a number of sources as well as for storing the art they create themselves.

Microsoft Windows is a helpful conduit for passing reusable images, but it doesn't make the chore of retrieval any less repetitive. Each time you want to retrieve an image, you'll have to fire up several applications. What's more, the *Windows* Clipboard stores only one image at a time, and the source and host files must be in the same formats.

But there is a utility that can do what *Windows* can't. *ClickArt Scrapbook+*, from T/Maker Co. (publisher of the *ClickArt Series*, which is also reviewed in this issue) stores multiple images that are cut-and-pasted to a clipboard. The program makes use of the *Windows* Clipboard, an elephant-like memory, and a visual database to store, organize, and retrieve all sorts of text and graphics. It also doesn't require that the native application be present for its images to be used.

As its name suggests, the program uses a scrapbook metaphor. A scrapbook can store text or graphics. You bring images into a scrapbook through the *Windows* Clipboard or, in the case of non-*Windows* applications, through an import procedure. Individual images are stored as pages; pages are stored as files. Once an image is stored in a scrapbook you can reverse the process and pop it into an application through the *Windows* Clipboard or by exporting it in the appropriate format. In this regard, the program serves as a graphics translation engine, allowing you to import and export files in an impressive number of formats: .MSP, .EPS, .PS, .RTF (Rich Text Format), .DIF, .SLK, .WMF, .TXT, .CSV, and TIFF. Notably missing from this list is the .CGM format.

Two automation tools speed scrapbook creation. AutoPaste automatically pastes any image cut to the Clipboard into the scrapbook. Camera, a screen-capture utility, pastes any *Windows* screen into a scrapbook in bitmap format. A few simple editing tools afford you some control over the images.

You can peruse a scrapbook in a number of ways. You can flip through your images, each of which is displayed as a full screen, but you'll probably find it more useful to display them as thumbnail sketches. In this approach, the contents of a file are reduced to a matrix of miniature images. You can quickly scroll through pages of these miniatures to locate the image you need.

You can also view several thumbnail sketches on the bottom of the screen, with an enlarged view of the currently selected page at the top. Or, you can use a scrapbook as a visual database by assigning descriptive comments to each page and then conducting text-based searches.

In all, *Scrapbook+* is a helpful answer to the problem of managing volumes of images. If you spend a lot of time cutting-and-pasting in *Windows*, this art organizer just may streamline your work. ■

FACT FILE

ClickArt Scrapbook+
T/Maker Co., 1973 Landings Dr., Mountain View, CA 94043; (415) 962-0195.
Price: $129.95.
Requires: *Microsoft Windows*, Version 2.03, or *Windows/386*, or any program that uses runtime *Windows* 2.03 or later; mouse; light pen or touch pad and a hard disk are recommended.
In Short: A clip-art organizer for the *Windows* environment that streamlines the chore of cutting-and-pasting multiple images.

CIRCLE 411 ON READER SERVICE CARD

QUALITY OVER QUANTITY

But once you hook your picture, the catch is delicious. The collection includes a smattering of everything, including computers, people, animals, decorative accents, and text strings. It does not offer many choices within a category: Rick Barker, the talent behind *Click & Clip*, is a graphic artist by trade, and his focus appears to be on quality rather than quantity.

Some of his images are simple, but elegant, line drawings. Others, such as a hamburger, a pair of sunglasses, flowers, or a dollar bill, are sophisticated renderings that make full use of PostScript fills and patterns. Because Barker has taken care of choosing the PostScript fills and gradations for you, you're freed from the painful trial-and-error process of trying to map color or black-and-white clip art to the PostScript fills.

If you need a collection of quality images mainly for desktop publishing, *Click & Clip* is well worth your consideration. But be prepared to hunt for the right picture.

ClickArt Series

by Robin Raskin

A prolific generator of black-and-white computer clip art, T/Maker Co.'s origins are in the Macintosh world, though its *ClickArt Series* of bitmapped clip art (in .PCX format) for the *Windows* and GEM environments for the PC is now well known. And more recently, the vendor has channeled its efforts into the production of high-quality .EPS-format clip art for PostScript users.

The artwork in the *ClickArt Series* is diverse and plentiful. All told, there are over 2,000 individual black-and-white images housed in five bitmapped volumes, each costing $69.95: Business Images, Personal Graphics, Publications, Holidays, and Christian Images. The drawings range from logos, arrows, flags, currencies, headlines, map symbols, and other tasteful embellishments for your charts and maps to show-stealing, highly stylized images of cars, famous people, animals, and sports. The Publications volume contains pages of useful tools, including dingbats, stencils, and column heads.

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VGA/Color	$1054	$1129	$1334	$1484

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Options:

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- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable
- Full or Mini Size Tower® Case

Standard Pre-Built Configurations:

286/12 With 512K, Hard Disk Drive, Monitor & Video Card				
Drives / Video	40MB-46MS 1:1 RLL	66MB-25MS 1:1 RLL	71MB-18MS 1:1 MFM	110MB-25MS 1:1 RLL
Mono	$1207	$1432	$1572	$1672
VGA/Mono	$1402	$1627	$1767	$1867
EGA	$1547	$1772	$1912	$2012
VGA/16Bit	$1637	$1862	$2002	$2102

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- Enhanced 101-key AT Style Keyboard
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286/20 w/512K, Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB-46MS 1:1RLL	66MB-25MS 1:1 RLL	71MB-18MS 1:1 MFM	110MB-25MS 1:1 RLL	150-17MS 1:1 ESDI	320-16MS 1:1 ESDI
Mono	$1407	$1632	$1737	$1862	$2517	$2817
VGA/Mono	$1602	$1827	$1932	$2057	$2712	$3012
EGA	$1747	$1972	$2077	$2202	$2857	$3157
VGA/16Bit	$1837	$2062	$2167	$2292	$2947	$3247

PC BRAND 386/SX-16 $1099

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- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387SX Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM, and PCNET compatibility
- 8 Slot motherboard design (5 16Bit & 3 8Bit)
- Medium foot print case with 5 Disk Drive bays (Shown with optional Mini Size Tower® Case)

Options:

- Full or Mini Size Tower ® Case • Factory Installed RAM Upgrades
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable

Standard Pre-Built Configurations:

386SX-16 w/512K, Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB-46MS 1:1RLL	66MB-25MS 1:1 RLL	71MB-18MS 1:1 MFM	110MB-28MS 1:1 RLL	150-17MS 1:1 ESDI	320-16MS 1:1 ESDI
Mono	$1507	$1732	$1837	$1962	$2617	$2917
VGA/Mono	$1702	$1927	$2032	$2157	$2812	$3112
EGA	$1847	$2072	$2177	$2302	$2957	$3257
VGA/16Bit	$1937	$2162	$2267	$2392	$3047	$3347

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- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Dual Hard Drive/Floppy Drive controller, 977.6 KB/SEC Caching Controller w/ESDI Configurations
- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287, 80387 Co-Processor Support
- Phoenix BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- 8 Slot motherboard design (5 16Bit & 1 8Bit & 2 32/8Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- Full or Mini Size Tower ® Case • 8MB 32Bit RAM Card Upgrade
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable • Weitek Co-processor

Standard Pre-Built Configuration:

386/20 With 1024K, Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB-46MS 1:1 MFM	66MB-25MS 1:1RLL	71MB-18MS 1:1 MFM	110-25MS 1:1 RLL	150-17MS 1:1ESDI	320-16MS 1:1ESDI
Mono	$2125	$2225	$2350	$2460	$3010	$3455
VGA/Mono	$2310	$2410	$2535	$2645	$3195	$3640
EGA	$2415	$2515	$2640	$2750	$3300	$3745
VGA/16Bit	$2555	$2655	$2780	$2890	$3440	$3885

PC BRAND 386/25 $1849

25 MHz Clock, Zero Wait Operation
Norton SI 28.2 • Landmark Speed 33.6MHz
Norton SI 31.6 • Landmark Speed 43.5 w/Cache
1024K, 1.2MB or 1.44MB Drive, 101-Keyboard

Standard System Features:

- Intel 80386 Processor Operating at 25MHz with Zero Wait States in interleave mode delivering 34 to 44 MHz Effective Throughput
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- Enhanced 101-key AT Style Keyboard
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80287, 80387 or Weitek Co-Processor Support
- AMI BIOS with full MS/DOS, OS/2, XENIX, NOVELL, 3COM and PCNET compatibility
- User configurable I/O timing permitting compatible operation with older peripherals or faster I/O for newer devices
- 8 Slot motherboard design (5 16Bit & 3 8Bit & 2 32Bit)
- Medium foot print case with 5 Disk Drive bays

Options:

- 32KB or 64KB Cache Processor • Weitek Co-processor • Tower ® Case
- Custom configurations w/Name Brand peripherals of your choice
- Compaq® Style LCD or Plasma Portable • 8MB 32Bit RAM Card

Standard Pre-Built Configurations:

386/25 With Hard Disk Drive, Monitor & Video Card						
Drives / Video	40MB-46MS 1:1MFM	66MB-25MS 1:1RLL	71MB-18MS 1:1 MFM	110MB-25MS 1:1RLL	150-17MS 1:1ESDI	320-16MS 1:1ESDI
Mono	$2312	$2462	$2592	$2722	$3322	$3572
VGA/Mono	$2527	$2677	$2807	$2937	$3537	$3787
EGA	$2672	$2822	$2952	$3082	$3682	$3932
VGA/16Bit	$2762	$2912	$3042	$3172	$3772	$4022

CRT display is courtesy of RIX Softworks,Inc. Irvine, CA.

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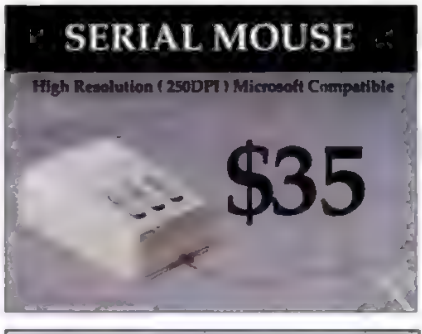

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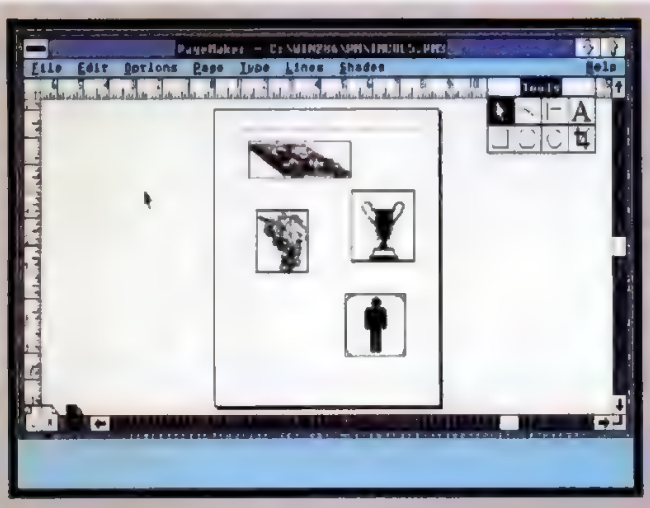

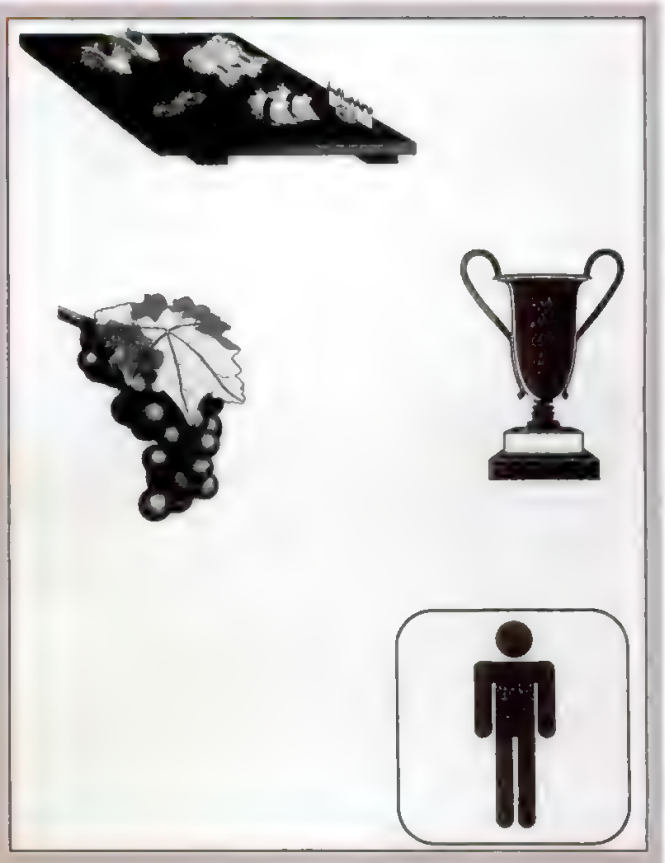

T/Maker's *EPS Illustrations* collection from the *ClickArt Series* is an eclectic mix of carefully rendered images with numerous textures and shadings. On-screen you see only a bitmapped representation of the final output; you can't even tell from the screen that the top-left image is pieces of sushi.

The files correspond to thematic categories, with each file containing many images. Though less flexible than keeping each image in a separate file, this system works well because it lets you compare many related images on the screen at once. It also takes up much less disk space—the Business Images volume, for example, which contains 1,000 pieces of art, fits onto just two disks, making it practical to put the whole collection on your hard disk.

Of course, once you've chosen an image, you'll need to use the editing tools in your paint or desktop publishing package to isolate it by saving it in a separate file or pasting it to the *Windows* clipboard. If you don't have a program to do this, you can use T/Maker's *ClickArt Scrapbook+*, a *Windows*-based art organizer, to store the images you select in a more useful form.

LOOK BEFORE YOU BUY

The number of images contained in a file varies according to their complexity. For example, in the Business Images series, the Industrial file contains 43 images, while the Templates file has 79 symbols used to compose flowcharts and organizational charts, and the Symbols file has 104 commonly used images such as typewriters, pencils, tools, stamps, disks, and so on. By contrast, the Personal Graphics volume, which contains much more stylized and intricate images, such as Rodin's *Thinker*, Albert Einstein, the *Mona Lisa*, light bulbs, cameras, and even Ronald Reagan, has just 130 images in all. For this reason, you should look at the full *ClickArt Series* before you decide which volumes to purchase.

The installation program that comes with the package forces you to copy the files onto a another floppy disk or to your hard disk, a time-consuming (though prudent) requirement. If you install the images under the *Windows* environment, the installation program automatically converts them from the .PCX format, in which they are shipped, to the .MSP (*Microsoft Paint*) format. In any case, you can easily convert images from one bitmapped format to another by using *ClickArt*'s small but powerful exchange utility, which supports the *Microsoft Paint* (.MSP), GEM (.IMG), .PCX, and *MacPaint* (.MAC) formats.

EPS IMAGES

Unlike bitmapped clip-art, the *EPS Illustrations* ($129.95) and the *EPS Business Art* ($129.95) series of Encapsulated PostScript illustrations are still in their infancy. The full seven-disk set, containing 180 images in 127 files, is more like a sampler than a useful collection. Though the images are delicious—smooth, intricate, and carefully shaded—there aren't enough of them for the working artist to depend on with any regularity.

The subject matter in this series is eclectic to the point of randomness. There's one plant, one airplane, a few foods, a few animals. But you also get many variations on some themes, which decreases the diversity of subject matter. For example, you get three identical telephones, one black, one white, and one gray, and a U.S. map in black, white, and three-dimensional versions.

Despite these limitations, these .EPS images are the cream of the T/Maker crop. The drawings, which are created using *Adobe Illustrator*, are clean, crisp, and sophisticated. Moreover, you can stretch and scale these images to your heart's content,

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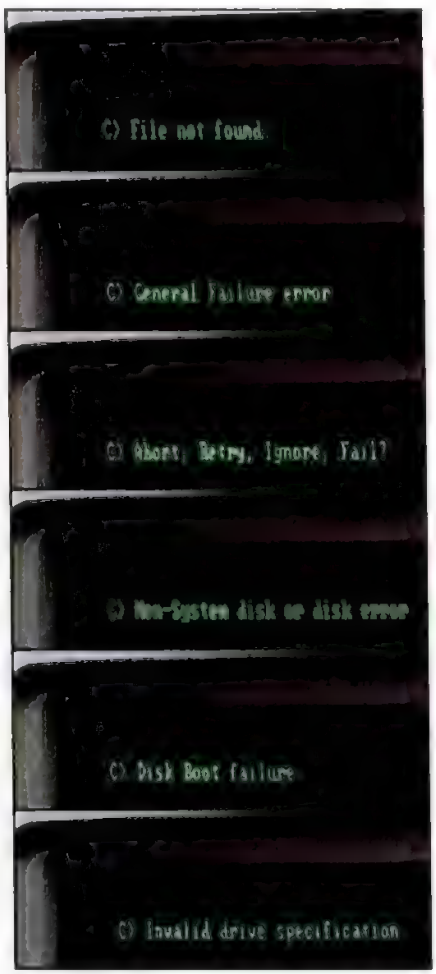

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FACT FILE

ClickArt Series
T/Maker Co., 1390 Villa St., Mountain View, CA 94041; (415) 962-0195.
List Price: *ClickArt Series* libraries (Business Images, Personal Graphics, Publications, Holidays, Christian Images), $69.95 each. *EPS Illustrations*, $129.95; *EPS Business Art*, $129.95.
Requires: *ClickArt Series* libraries require any graphics program accepting .PCX, .MSP, .IMG, or .MAC file formats. *EPS Illustrations* and *EPS Business Art* require a graphics application that accepts Encapsulated Postscript files. RAM, disk, and DOS requirements depend on graphics package used.
In Short: T/Maker's line of .PCX-format images offer reasonable quality at a competitive price. There are many images in a file, so you can see several on the screen at once. The *EPS* series is splendid-looking but rather thin in variety.

CIRCLE 497 ON READER SERVICE CARD

and they still look terrific.

Unlike the bitmapped series, there is no install procedure that forces you to copy the images to a floppy or your hard disk. However, the retrieval scheme is a trifle flawed. The images are organized alphabetically, but the disks themselves are numbered (one through seven). To use an image, you must find its name in the visually organized reference manual and then look through the index to find out which one of the numbered disks contains the image. A more straightforward approach would be to include the disk reference with the name, or else to label each disk with the alphabetical range it contains.

The *ClickArt Series* offers acceptable bitmapped images at a reasonable price. The files are small enough to let you keep the whole collection on your hard disk, which somewhat offsets the inconvenient reference scheme. The *EPS* series promises much higher quality in the future, but only after the company has released enough of a variety to make it usable.

Clip3D Library

by Luisa Simone

Most clip art consists of two-dimensional representations of commonplace objects. Since the drawings exist as flat shapes or outlines, you must use them as they were drawn. But the *Clip3D Library* from Enabling Technologies Inc. releases you from these constraints. Instead of flat images, *Clip3D* contains three-dimensional colored objects that have depth as well as height and width. Suddenly, a whole new world is opened, one where common objects can be viewed from uncommon perspectives. Flip an image of a penny, and the Lincoln memorial appears instead of Abe's face.

Clip3D objects are arranged into eight volumes: Geography, Business, Accents, Lifestyle, Recreation, Fonts, Messages, and People. The libraries, which cost $99 each and average about 150 files, are hit-and-miss. When the images do hit, they are a bulls-eye, but the relatively low proportion of hits to misses is a major failing of the product.

The object-oriented images themselves are, paradoxically, both sophisticated and naive. Many of them are just not detailed or elegant enough for serious business presentations. The compromise is understandable—you can't model true three-dimensional objects without sophisticated mathematical constructs, and this puts great demands on the memory, storage, and processing power of the PC. But for images where details count, such as people, such simplification is a bad idea.

You can circumvent this problem to a degree by choosing your images carefully. The sculpted plastic look of the objects is least offensive when you use them to represent objects that really are made of sculpted plastic, such as TVs or chairs. You can also increase the apparent refinement of an image by composing scenes that contain several objects. But no amount of rotating or stretching will give human features to a rhomboid.

CHANGING PERSPECTIVES

The most impressive part of *Clip3D* is the program that allows you to manipulate the objects. Enabling Technologies first developed this technology for *Pro3D*, its solid modeler. The working views—front, back, top, bottom, left, and right—are live views, in that you can change the position of the objects as they relate to one another. The program also offers a camera view, in which you can change the angle at which you view a scene—in effect, you are the one who is moving, and the scene changes accordingly.

Clip3D runs under *Microsoft Windows* and uses icons to control the size, proportion, rotation, ambient lighting, and per-

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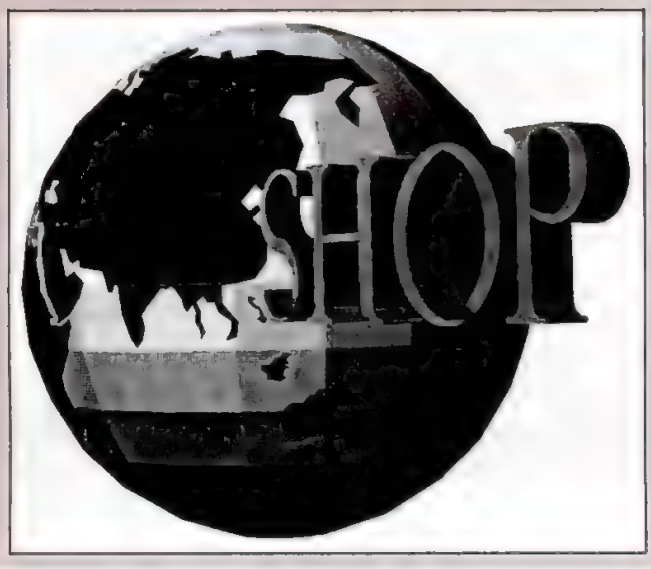
CIRCLE 740 ON READER SERVICE CARD

Clip3D Library's object-oriented color images translate well into black-and-white printouts. The word *shop* in this composition was created by importing each letter as a separate object. Once you've merged the elements into a single object, it's easier to reposition and color the entire word.



spective of any given object. Drop-down menus contain all of the expected commands, such as color and line-width attributes, as well as powerful features like custom lighting and merging objects. As a result, using the program is very easy. If you have even a modest familiarity with *Windows* programs, you will be able to navigate the logically structured menus effortlessly. Just load the program, work your way through its straightforward tutorial, and you will find yourself a veritable expert at three-dimensional manipulation within a few hours.

I found few commands lacking. I would include the ability to group and ungroup objects in three dimensions. I would also add an installation and retrieval program—right now, directory names and filenames are the only clues you have to the contents of the files.

A STRAIN ON RESOURCES

The program delivers fairly good performance, considering the difficulty of getting a true 3-D program up and running on a PC. You must wait a bit for the screen to redraw, but on a 286 or 386 machine the penalty isn't all that severe. But the strain it puts on the PC's resources is apparent in the merge function. Because combining two solid objects involves such an enormous number of coordinates and calculations, merging objects is a one-way street—the program just can't keep all of the previous coordinates in memory to perform an undo. And about ten percent of the time, the merge function just doesn't work—objects pass through the mathematical transformations and emerge as geometric monsters.

Once you've created an image from the object, it is stored in a proprietary format, so to use it in another application you must translate it into a more conventional format. *Clip3D* exports images into PICT, TIFF, .WMF, and .PCX formats, as well as into regular or Encapsulated PostScript formats. Although the export function works flawlessly, you will find that you spend quite a good deal of time fiddling with things like lighting effects and contrast levels to obtain the optimum printing results. What is helpful is that the same data structure is used in the Macintosh version of the product and in the CD-ROM version that is marketed by NEC Home Electronics ("Archives in Miniature," *PC Magazine*, January 31, 1989).

Be prepared for large files. The art we created for our test document logged in at 88K of RAM, and consequently we were unable to save it as a *Windows* Metafile (.WMF), which tops out at 64K of RAM. Such big files can be problematic for other applications when saved to vector-based formats. The PICT version of the test image, for example, was too complex for *PageMaker* to import.

Clip3D has real potential. We seldom think of three-dimensional spatial relationships as an important element in a drawing, but the ability to spin, rotate, foreshorten, and combine three-dimensional objects makes *Clip3D* an amazing graphics tool. However, to make this program really useful, the objects should be rendered with meaningful detail. Until then, frustration over the limitations of the images may outweigh your delight with the special effects you can achieve.

Clip3D Library
Enabling Technologies Inc., 600 South Dearborn, Chicago, IL 60605; (800) 544-0629, (312) 427-0408 in Illinois.
List Price: $99 per volume (available volumes include People, Accents, Fonts, Recreation, Geography, Lifestyle, Business, and Messages; additional volumes forthcoming).
Requires: 512K RAM; hard disk; *Microsoft Windows* (any version); mouse; CGA, EGA, or VGA graphics adapter; DOS 2.0 or later.
In Short: This unique collection of three-dimensional "objects" gives you unparalleled versatility in selecting different views and lighting schemes. But the limitations of the medium are painfully evident in the poorly detailed and inelegant images that result. Until the technology improves, this one is at best a curiosity.

CIRCLE 406 ON READER SERVICE CARD

Corel Draw!

by Robert Kendall

Corel Draw! has created something of a stir in the PC graphics community. Though a relative newcomer, this outstanding product from Canadian-based Corel Systems garnered an Editor's Choice in our most recent roundup of drawing packages ("Fine Lines: The PC as Illustrator," *PC Magazine*, June 27, 1989). In addition to a host of powerful graphics editing features, this $495 *Windows*-based package also includes a small, color clip-art library of object-oriented images.

Corel has taken an unusual but sensible approach to clip art. Rather than trying to supply a comprehensive library of images, the company has included 90 pictures of its own with Version 1.02 and a sampling from the libraries of two other Canadian vendors: *ArtRight Image Portfolios*, from ArtRight Software, and *Presentation Task Force*, from New Vision Technologies (both of which also appear in this roundup). All together, the collection amounts to about 200 images. If you like what you see in these samples, you can order additional clip art directly from ArtRight or New Vision. And it gets better. With the release of Version 1.1, which is expected to be on the shelves by the time this issue hits the newsstands, Corel will include clip art samples from a total of 12 third-party vendors.

The installation procedure for *Corel Draw!* will automatically create subdirec-

Corel Draw!,
Version 1.02
Corel Systems Corp.,
1600 Carling Ave.,
Ottawa, Ontario,
Canada K1Z 8R7; (613)
728-8200
List Price: $495
Requires: 640K RAM, hard disk, *Microsoft Windows* 2.0 or later, graphics card and monitor, DOS 3.0 or later.
In Short: This first-rate drawing package includes a small sampler of clip art from Corel and two third-party vendors. The scope of this library is quite narrow, but the pictures are of high quality, and you can supplement them by buying additional artwork from the other two vendors represented.

CIRCLE 409 ON READER SERVICE CARD

CIRCLE 149 ON READER SERVICE CARD

MOVING?

Please write to: PC Magazine, P.O. Box 54093, Boulder, CO 80322. Include your mailing label from a recent issue of PC Magazine for faster service. Please allow up to 60 days for change of address to take place.

These business images from *Corel Draw!*'s *Presentation Task Force* library are displayed in the program's preview mode. All images are constructed from a number of discrete objects, and many make use of color. The color images often suffer in the translation to black and white by printing rather dark, as in the example shown.

tories for each of the three libraries and then copy the pictures onto your hard disk, as long as you have 2MB of free disk space. Or you can call up the pictures from floppy disks. All the images come in *Corel*'s native .CDR object-oriented format.

As you would expect from a library of this size, the range of its contents is quite limited. The selection created by Corel itself consists mostly of maps, including outlines of all 50 states. There are also flags, a few miscellaneous symbols, and a handful of people from various walks of life, all rendered quite simply.

Surprisingly, about half of the ArtRight selection consists of road signs, a category of limited value to most users. The remainder of this vendor's images are mostly nonsense depictions of various vehicles interspersed with such sundry objects as a laser printer, a fire extinguisher, and a kitchen range.

New Vision offers the most varied assortment, as well as the most sophisticated images. The illustrations take their subject matter from business, manufacturing, transportation, medicine, computer technology, the military, and other areas. There's also a handful of borders and arrows. The style of the pictures ranges from realistic depictions of people to stylized images of objects to cartoons.

Corel Draw! has taken an unusual approach to clip art. The package includes 90 pictures of its own and a sampling from two other vendors.

Most of the images from all three vendors make good use of color, a boon for anyone with a color output device. Images designed in color can lose some definition in their details when printed in black-and-white, however, and this loss is occasionally a problem with these files. But for the most part, printed output looks crisp and attractive.

Of course, if you don't like any of the colors or fill patterns in a picture, you can modify them with *Corel Draw!*'s editing tools. And if you want to change sizes or proportions, the object-oriented format lets you stretch an image to any size without creating jagged edges.

Corel Draw! can export files in .EPS, TIFF, .PCX, *Windows* Metafile, and IBM .PIF formats, so you can use its artwork in most major graphics and desktop publishing programs. You can also import and modify images in these and a few other formats and add them to your *Corel* library. Be forewarned, though, that conversion can be extremely time-consuming.

The package includes a separate catalog of the clip art. It's not printed in color, but the images are logically organized. Each picture corresponds to a separate file with a descriptive filename, making objects easier to find.

The sampler approach is an intelligent one, but including selections from only two third-party vendors doesn't allow enough variety for the approach to work as well as it could. Hence, Corel plans to add over 100 images from ten other vendors to the clip-art collection with Version 1.1 of *Corel Draw!*. Among the companies represented will be Metro ImageBase, Dynamic Graphics, Marketing Graphics, and

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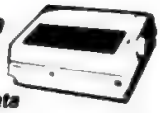

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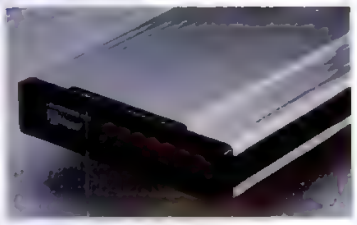

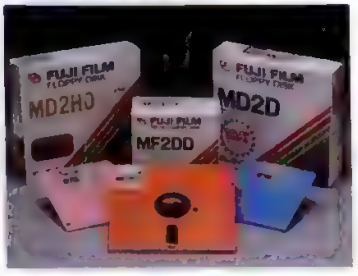

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CIRCLE 535 ON READER SERVICE CARD

DreamMaker. These new additions will offer files in .EPS, .PCX, and .CGM formats (the capability to import and export the latter will also be added to the *Corel Draw!* upgrade). And finally, Version 1.1 will support the *Windows* Clipboard, allowing users to cut-and-paste graphics between *Corel Draw!* and other *Windows* applications.

As the *Corel Draw!* clip-art library stands at review time, it's a limited, albeit high-quality, collection that's quite idiosyncratic in its subject matter. Hopefully, by bringing more vendors on board, Corel will be able to turn its clip-art library into a truly effective sampler. Either way, you certainly couldn't find a more powerful tool than *Corel Draw!* for viewing, editing, and converting clip-art files.

These .EPS images from the Potpourri 1 library of *DeskTop Art/EPS* are shown here imported into *PageMaker*. TIFF-format image headers attached to the .EPS files let you see the bitmapped images on-screen.

DeskTop Art

by Robert Kendall

Dynamic Graphics has been in the clip-art business for more than 2 decades, and it shows: the company now offers a library of over 20,000 graphic images. Most of this huge collection is available only as camera-ready art, but more than 1,600 of the artistic adornments are available in the *DeskTop Art* series for the PC. These eight libraries of bitmapped images (in .PCX format) sell for $74.95 each and range in subject matter from the corporate office to Christmas scenes.

As you would expect, the draftsmanship in these illustrations is exemplary. The collection is admirable in scope, encompassing both the whimsical and the purely utilitarian and ranges from the realistic to the highly stylized. If you're looking for light-hearted pictures to liven up a business presentation—say, a tiger in a three-piece suit or a cartoon character shrinking from a menacing PC—you'll find them here. You'll also find symbols suitable for representing financial elements, transportation, different professions, and other standard themes, as well as detailed, naturalistic depictions of numerous animals and of people engaged in a diversity of activities.

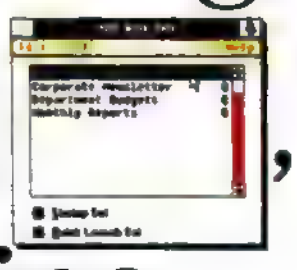
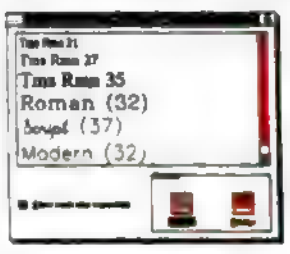
Separate libraries are devoted to business, education, health care, sports, and seasonal fare. A borders library offers ornamental corners and plaque-like backgrounds, while two additional libraries offer a potpourri of images for miscellaneous needs. The series isn't quite encyclopedic, however. None of the libraries includes maps, and you won't find such elementary items as check marks, arrows, letters of the alphabet, or flowchart symbols. To be fair, though, the latter items are the least important components of a clip-art library, since you can create them relatively easily by using a graphics program.

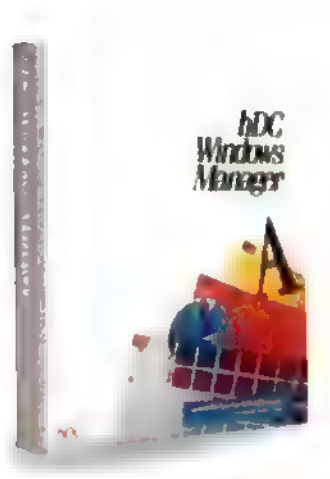
GOOD ART BADLY ORGANIZED

Dynamic Graphics provides no facilities for editing or viewing the files; you'll need a .PCX-compatible paint or viewing program for that. But each collection comes with a booklet that discusses the basics of manipulating pixel-oriented images and using them effectively in documents, as well as a catalog of the images in the collection.

When it comes to organization, the *DeskTop Art* series loses some of its luster. Dynamic Graphics chose to put five or six images into each .PCX file to save disk space; unfortunately, as often as not the pictures within a file are not really related to one another, so it is sometimes very difficult to find what you need. For example, depictions of money are scattered throughout some 25 different files in the *Business* library, interspersed with images of virtually every other aspect of business.

If your application doesn't let you manipulate images, you'll have to use a paint program to copy the image you want into a file of its own. If you're using a desktop publishing package, you can bring in the entire file and then crop it to display only the image you want. But portions of un-

Introducing hDC Windows Manager and MicroApps. The Windows-enhancing, desktop-customizing, file-saving , work-organizing  , memory and  font viewing, appointment-reminding utility for Microsoft Windows.



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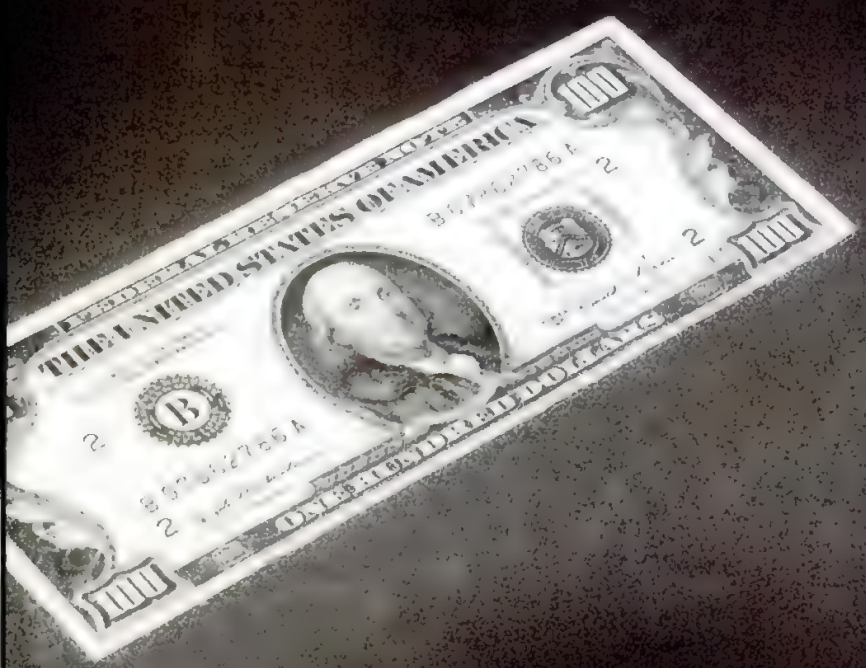

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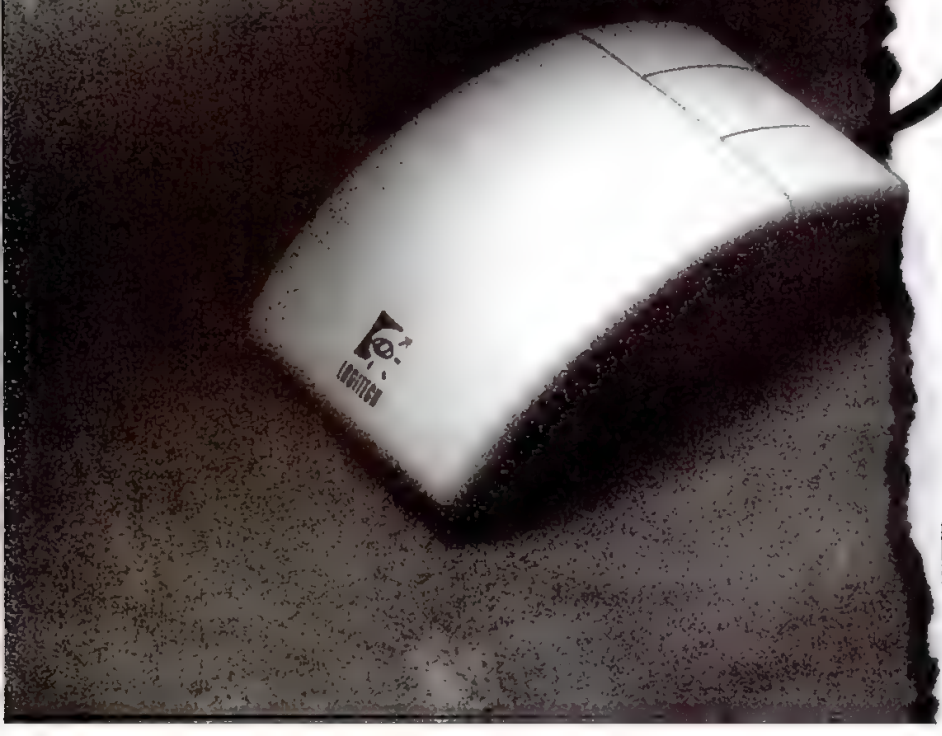

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FAST FILE

DeskTop Art
Dynamic Graphics Inc., 6000 N. Forest Park Dr., Peoria, IL 61614; (800) 255-8800.
List Price: *DeskTop Art*, $74.95 per edition (editions include Education, Sports, Business, Health Care, Borders and Mortices, Graphics and Symbols, Artfolio, Four Seasons). *DeskTop Art/EPS*, $74.95 per edition (editions include Potpourri, Commerce, Seasonal, Design Elements, Athletics, People, Sales and Presentation; additional editions forthcoming). EPS editions also available through membership in the Designers Club for $49.50 per month (members receive one edition each month).
Requires: *DeskTop Art:* any graphics application that accepts .PCX-format files. *DeskTop Art/EPS:* any graphics program that accepts .EPS-format files. RAM, disk, and DOS requirements depend on graphics package used.
In Short: The high artistic quality and excellent variety in this professional clip-art collection is offset by its chaotic disorganization. Its .PCX-format bitmapped images also have rather low resolution. The newer .EPS-format series is much better in this regard, and the files come with TIFF-format images for screen viewing, but at a steep price.

CIRCLE 412 ON READER SERVICE CARD

wanted elements can intrude upon the rest of the document unless you cover them up with invisible graphics boxes. Altogether, it's not an elegant solution.

EPS IN THE FUTURE

DeskTop Art's other liability is that its images are bitmapped, which makes for relatively low-quality printed output, especially if you expand an image to a larger size. Aware of this limitation, the vendor has initiated a *DeskTop Art/EPS* series in Encapsulated PostScript format. Although only a handful of .EPS collections were available at review time, Dynamic Graphics plans to issue one a month, covering such diverse themes as business, people, animals, travel, and religion. You'll be able to pick them up for $74.95 each or for $49.50 per month through membership in the vendor's Designers Club.

Since each package contains only 40 or 50 pictures, this puts the cost at over a dollar an image. But the output quality can't be beat, and each picture is stored in its own file. Moreover, each .EPS file has a TIFF-format image appended to it, allowing you to see the image on-screen when you position it in a desktop publishing document.

For artistic quality, as well as for variety in subject matter and stylistic conception, it's hard to do better than *Desktop Art*. But its bitmapped format puts a ceiling on print quality. If you want more than what .PCX files can give you, you'll need a healthy budget to explore the new .EPS offerings.

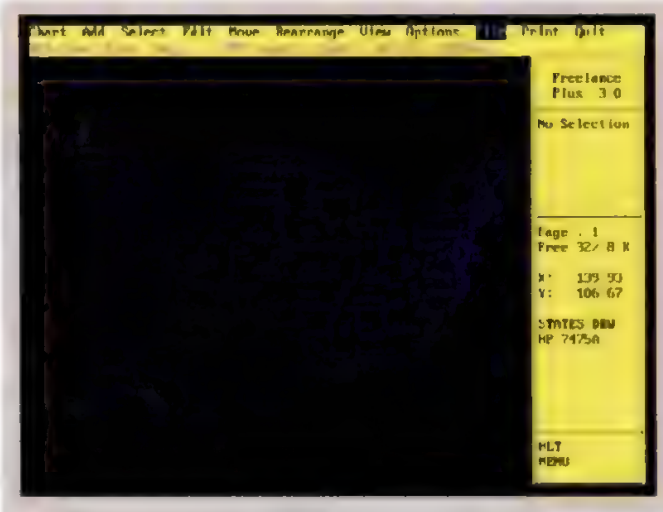
Freelance Maps

by Bruce Brown

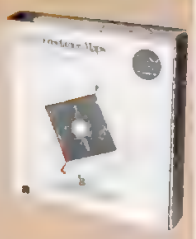
Somebody had to do it. Somebody had to put together a fairly comprehensive collection of maps of the major regions of the world that could be displayed and played with on the PC. Maps may not be the most interesting design element in the world, but they certainly are useful in many types of graphic representations. And since the .DRW file format of Lotus Development Corp.'s *Freelance Plus* is one of the standards in the graphics world, you can use the same vendor's *Freelance Maps*, a library of bitmapped images, with any other application that imports .DRW files. If you already own *Freelance Plus*, you can export the maps in HPGL, .PIC, .CGM, .EPS, or TIFF formats for even wider use.

Freelance Maps, U.S. Complete Set ($395), with 728 files on 14 disks, covers all United States counties, major cities, and metropolitan service areas, as well as three-digit ZIP code areas and congressional districts. Each map includes major and subordinate region outlines and a complementary set of labels.

The Continents and Countries Set ($145) comes on 2 disks and contains 36 files. It includes outlines and label sets for the whole globe and for each continent, as well as Atlantic and Pacific world-perspective maps. It also includes special maps for Canada, including a national map and a map of the provincial boundaries with a province label set. All of the maps are two-dimensional and in black and white, but of course you can add colors and patterns using *Freelance Plus* or another drawing program.



True to its name, *Freelance Maps* includes simple state maps as well as maps of ZIP codes and congressional districts. Since Lotus's *Freelance Plus* gives you the ability to enlarge or reduce the bitmapped images, you can effectively scale the maps to fit any space.



Freelance Maps
Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142, (617) 577-8500.
List Price: U.S. Complete Set, $395; Continents and Countries Set, $145.
Requires: 640K RAM; hard disk; *Lotus Freelance Plus* 2.0 or 3.0, Hercules, CGA, EGA, VGA, or MCGA video adapter; DOS 2.0 or later.
In Short: If you need lots of maps and have plenty of money, this package fills the bill, at least for the United States and Canada.

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Unfortunately, you have no way of displaying a library of the maps on-screen and no visual catalog of them to aid in selection. The Continents and Countries Set includes only an annotated listing of all files, while for the hundreds of files in the U.S. Complete Set you're given only the various keys used with the state postal abbreviations to make up the filenames. For example, the congressional district maps are labelled ALCG.DRW (Alabama) through WYCG.DRW (Wyoming) on a state scale and ALCG-US.DRW through WYCG-US.DRW on a national scale. Fortunately, a table of state postal codes is included.

The documentation is slim, consisting of just 30 pages that help you to decipher the cryptic filenames and give you guidelines and helpful hints for using the maps in various applications. A glossary of graphics and map terms is also included. If you need instructions on retrieving, editing, displaying, and printing these graphics, you'll have to go to the *Freelance Plus* documentation.

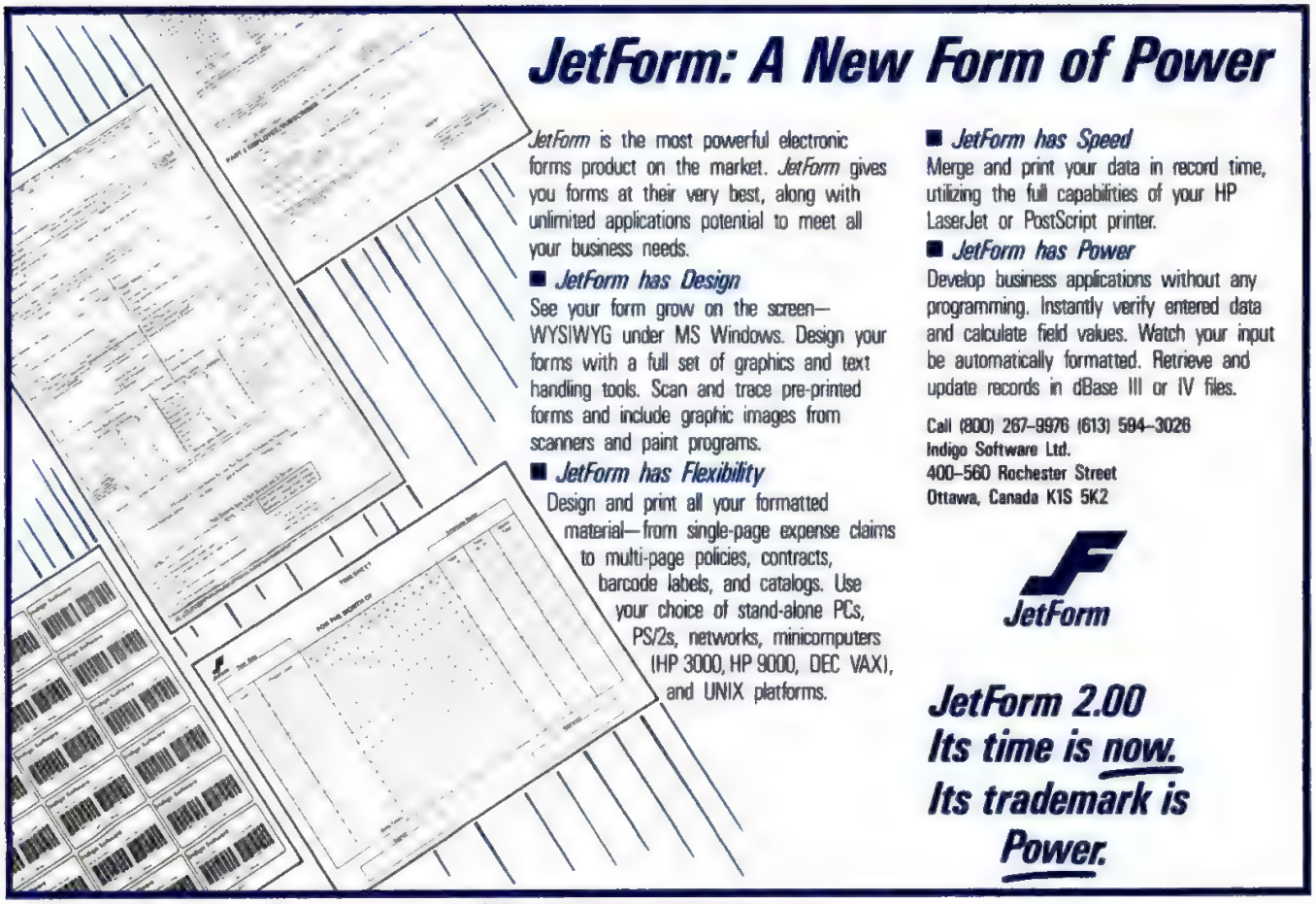
If you need maps, they're here. The individual files aren't sold separately, and if you need just one map, it may be cheaper to get someone to scan in the map for you in another program and then convert it to a .DRW file. But while $345 is probably too much to pay for just one copy of a map, if you need lots of good-quality maps regularly, including political boundaries and labels, *Freelance Maps* is there for you.

Harvard Graphics Accessories

by Robin Raskin

You probably wouldn't run out and buy *Harvard Graphics* just for its clip art libraries. The $495 base package includes 300 very simplistic, object-oriented, color clip-art images, but these are the weakest part of the program. They are geared to the least common denominator of output quality and lack both substance and artistic flair.

In order to remain clip-art competitive, Software Publishing Corp. has beefed up its collection of images. But it has chosen to sell the new images separately in the Business Symbols set. The symbols may also be purchased as part of a $495 quintet of add-ins that also includes U.S. MapMaker (an interactive map-creation package), ScreenShow Utilities (a screen-capture utility and electronic demo maker), QuickCharts (a collection of common chart templates), and Designer Galleries (a set of design templates for charts). This marketing decision means, essentially, that you must pay extra for clip art from



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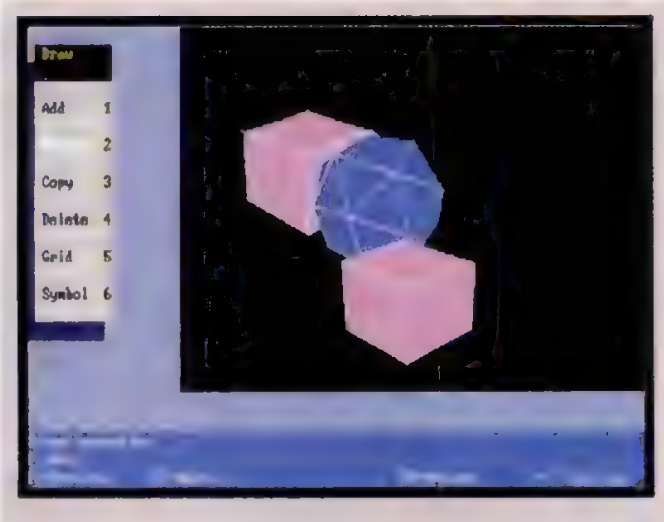

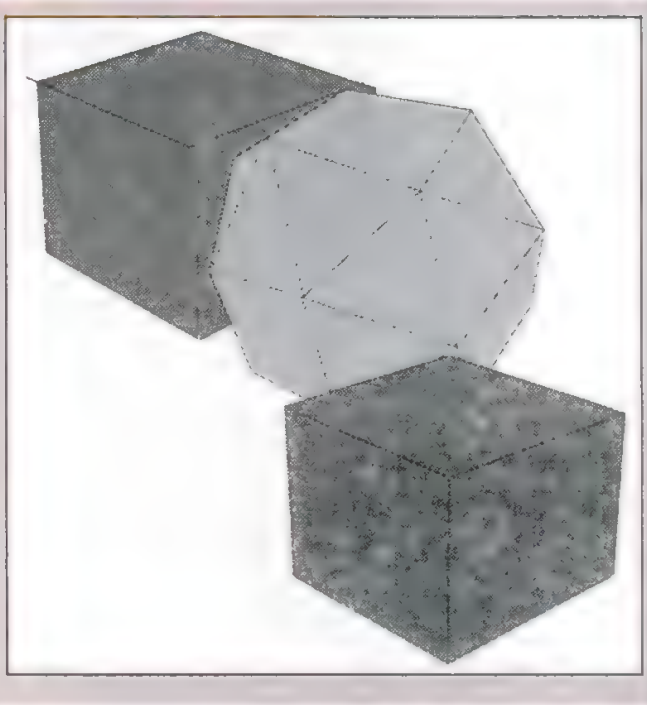

The Business Symbols library adds three-dimensional shapes to the simple, object-oriented *Harvard Graphics* repertoire. You can place them behind and in front of each other by using the program's powerful Background and Foreground commands.

Harvard Graphics that comes included with competitive packages such as *Freelance Plus*.

Still, the Business Symbols accessory adds to the *Harvard Graphics* repertoire and is an admirable step toward upgrading its sophistication. The images, which include transportation symbols, printers and plotters, traffic symbols, office equipment, math symbols, and three-dimensional shapes, are more complex than the clip art that comes with *Harvard Graphics*. But because *Harvard Graphics* doesn't handle curves or rotations, even these newer images tend to look stiff.

It's easy to find fault with *Harvard*'s clip-art aesthetics but hard to say anything bad about the program's image-retrieval, storage, and modification techniques. To retrieve an image, you simply call up a directory of clip-art libraries from a pop-up menu in the program. You'll see a grid with a selection of symbols, and you can select the one you want with a mouse or the cursor. You can store frequently used symbols in your personal library to make them easier to find.

Harvard Graphics' editing and modification tools have rightly won accolades. In an extremely straightforward manner, you can size or copy your clip-art image and add text to it. Using the Ungroup command, you can separate the component elements of an image and modify each one individually. While these features aren't in the same league as Bezier-curve drawing programs such as *Micrografx Designer* or *Arts & Letters Graphics Editor*, neither is the learning curve.

FILE EXPORT PROBLEMS

But *Harvard* falls short of the mark when it comes to exporting images to other programs. Though the file export facility works fine for creating slides and overheads from .CGM files, it's not particularly suited for exporting images to desktop publishing or drawing applications.

Used with *PageMaker*, the .EPS version of a Harvard image comes into the document as the ubiquitous gray box. Unfortunately, the size of the imported box is gigantic—so large that you need to scroll the document just to find the "handles" that you need to grab and size the image. Often you'll want the final size of the image to be quite small, and you'll need to work for a good long while to get the image down to normal proportions.

Unless you enlarge your original clip-art image to occupy the entire display screen before you export it, you can inadvertently lose your image. And because all that you can see as you work is a gray box, aligning the image precisely along a line or within a box becomes a matter of trial and error and repeated printings. The only sane way to do this is to place your images first and then put the text around them.

Exporting to .CGM format is no better. In our tests, *PageMaker* refused to recognize *Harvard*'s brand of .CGM, although it had no trouble with other .CGM flavors we were testing. In desperation, we used *Harvard*'s *ScreenShow Utilities* to capture the clip-art image on the screen and export it as a .PCX file. Though it works, this is a rather convoluted way to go.

The U.S. MapMaker accessory isn't really clip art, but it's worth a mention.

FACT FILE

Harvard Graphics Accessories
Software Publishing Corp., 1901 Landings Dr., Mountain View, CA 94039; (415) 962-8910.
List Price: Business Symbols, Designer Galleries, and Quick Charts, $99 each. U.S. MapMaker and ScreenShow Utilities, $149 each. Set of all five, $495.
Requires: 512K RAM; *Harvard Graphics*; Hercules, CGA, EGA, or VGA graphics adapter; DOS 2.0 or later.
In Short: Though these images are a bit crude, they come in a good variety for dressing up your presentations. But don't count on using them with anything other than *Harvard Graphics*—the program's export capabilities are simply not up to scratch.

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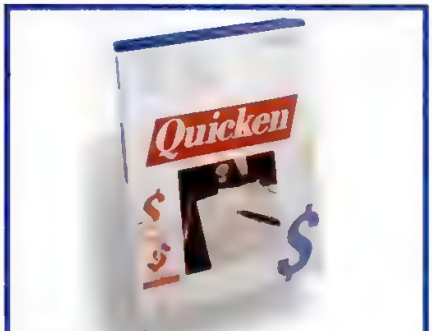

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3412 ■Grandview 1.0 ..... 189.
3425 □Q & A 3.0 ..... 219.
3431 □*Breakthrough* Timeline 3.0 ..... 369.

T/Maker ... NCP

5540 ■ClickArt Business Images ..... 45.
4185 ■Scrapbook+ 1.0 ..... 85.

TOPS ... NCP

3724 ■NetPrint 2.0 *(share printers)* .... 119.
3726 ■TOPS 2.1 ..... 115.
3725 TOPS Repeater *(network extender)* 129.
3720 *Flashcard 2.1 (AppleTalk network card; 1 year warranty)* ..... 159.

Traveling Software ... NCP

4190 Battery Watch 2.0 *(3½" only)* ..... 35.
3729 ■LapLink Mac 2.0 *(Mac-PC transfer)* 79.
5179 ■LapLink III ..... 85.
4891 ■ViewLink 1.0 ..... 95.
3727 ■DeskLink 2.21 ..... 99.

True BASIC, Inc. ... NCP

3561 ■True BASIC 2.1 ..... 52.

Vericomp ... NCP

3765 ■SoftBytes 2.0 ..... 35.

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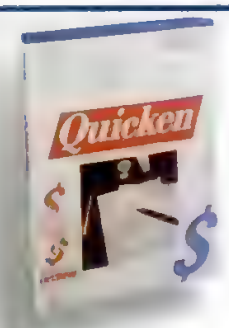

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▣*Quicken 3.0*–Slash the time spent on your finances by automating your routine financial tasks. Get the full picture with flexible, comprehensive reports such as balance sheets, net worth statements and more. . . . . $39.

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3799 ▣WordPerfect Library 2.0 . . . . . 75.
3798 ▣WordPerfect Executive 1.0 . . . . . 145.
3804 □WordPerfect 5.1 . . . . . 265.
3805 ▣WordPerfect Network 5.1 . . . . . 389.
3806 Additonal Network Stations 5.1 . . . . 89.

WordStar USA ... NCP

2825 □WordStar Prof. Release 5.5 . . . . 229.
5000 □*Upgrade to Release 5.5* . . . . . 89.

Wordtech ... NCP

3810 □DBXL 1.3 . . . . . 145.

Xerox ... NCP

4539 ▣Professional Extensions 1.0 . . . . 399.
3812 □Ventura Publisher 2.0 . . . . . call

XTREE Co. ... NCP

4512 ▣XTREE Pro 1.1 . . . . . 69.

XYQUEST ... NCP

4393 □XyWrite III Plus 3.55 . . . . . 229.

RECREATIONAL/EDUCATIONAL

Broderbund ... CP

1413 □Where/World Carmen Sandiego? . . 25.
1414 □Where/USA Carmen Sandiego? . . . 25.
1417 □Where/Europe Carmen Sandiego? 29.
4948 ▣JetFighter *(by Velocity)* . . . . . 35.

Electronic Arts ... CP

5698 □Abrams Battletank . . . . . 29.
5699 □Indiana Jones Graphic Adventure 35.
4804 ▣Life and Death . . . . . 35.
4659 ▣Chessmaster 2100 . . . . . 35.
5700 ▣Cribbage/Gin King . . . . . 42.

Microprose ... CP

4454 □F-19 Stealth Fighter . . . . . 39.
2725 □F-15 Strike Eagle . . . . . 22.

Microsoft ... NCP

2858 □Flight Simulator 3.0 . . . . . 35.

Mindscape ... CP

4897 □Gauntlet . . . . . 29.
2752 ▣Balance of Power 1990 . . . . . 33.

Parlor Software ... CP

3159 □Bridge Parlor 2.3 . . . . . 49.

Sierra On-Line ... CP

3405 ▣Thexder . . . . . $24.
4752 ▣Gold Rush . . . . . 25.
4455 ▣Leisure Suit Larry II . . . . . 33.
4345 ▣King's Quest IV *(512k version)* . . . 33.
5695 ▣Manhunter: San Francisco . . . . . 33.
4456 ▣Police Quest II . . . . . 33.
3404 ▣Space Quest II . . . . . 33.

Spectrum Holobyte ... NCP

3467 ▣Tetris *(addicting mind teaser)* . . . . 24.
4283 ▣Falcon/AT *(F-16 simulation)* . . . . . 32.
5187 ▣VETTE! . . . . . 32.

Stone & Assoc. ... NCP

3436 ▣Memory Master *(ages 2-6)* . . . . . 22.
3435 ▣My Letters,Numbers,Words *(2-6)* 22.
5231 ▣Phonics Plus . . . . . 22.
3439 □2nd Math *(ages 7-16)* . . . . . 27.

Sublogic ... NCP

4653 □Up Periscope . . . . . 25.
3335 □Jet *(requires CGA or EGA)* . . . . . 33.

True BASIC, Inc. ... NCP

3559 ▣Algebra 3 with Workbook . . . . . 39.
3590 ▣Pre-calculus . . . . . 39.

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Each with Workbook . . . . . $39.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

AST Research ... 2 years

1223 I/O Mini 2 C/S/P . . . . . 89.
1302 SixPakPlus 64k C/S/P . . . . . 129.
4107 RAMpage Plus 286 512k. . . . . 419.
4105 RAMpage Plus MicroChannel 512k 469.

Central Point ... 1 year

5042 Copy II PC Deluxe Option Board . . 115.

Compucable ... 2 years

1604 2-Position switch box . . . . . 25.
1605 3-Position switch box . . . . . 35.

Cuesta ... 1 year

1608 Datasaver 400 Watt *(power backup)* 429.

Curtis ... lifetime

1681 Curtis Clip CC-1 . . . . . $6.
1686 Disk Holder DB-1 . . . . . 8.
1718 3½" Disk Holder DB-2 . . . . . 8.
1704 Printer Stand PS-1 . . . . . 18.
1713 Filtered SafeStrip SPF-3 . . . . . 24.
1678 Universal System Stand SS-3 . . . . . 25.
1694 Emerald SP-2 . . . . . 36.
1707 Ruby SPF-2 *(6 outlets; EMI/RFI filtered; 6 ft cord)* . . . . . 55.
1708 Ruby-Plus SPF-2 Plus *(w/FAX & modem protection)* . . . . . 65.

DacEasy ... 1 year

3211 Breakthru 286-8 *(8 MHz accelerator)* . . . . . 225.
3210 Breakthru 286-12 *(12 MHz accelerator)* . . . . . 349.

Epson ... 1 year

We are an authorized Epson Service Center.

1906 FX-850 *(80 col., 264 cps, 9 pin)* . . . call
1904 FX-1050 *(136 col., 264 cps, 9 pin)* . . call
5183 LQ-510 *(80 col., 180 cps, 24 pin)* . . 349.
1930 LQ-850 *(80 col., 264 cps, 24 pin)* . . call
4117 LQ-950 *(110 col., 220 cps, 24 pin)* . . call
1917 LQ-1050 *(136 col., 264 cps, 24 pin)* call
4116 LQ-2550 *(136 col., 333 cps, 24 pin)* call
5184 LX-810 *(80 col., 180 cps, 9 pin)* . . . 199.
1052 Printer-to-IBM cable *(6 feet)* . . . . . 15.

We carry a full line of Epson accessories and ribbons. Call us with your needs.

5th Generation ... 1 year

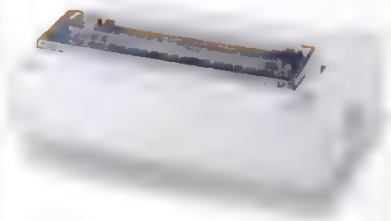
3952 Logical Connection 512k. . . . . 529.
4921 Logical Connection 1 Meg . . . . . 659.

Hayes ... 2 years

2304 Smartmodem 1200 . . . . . 289.
2305 Smartmodem 1200B *(w/Smartcom II)* 289.
2306 Smartmodem 1200B *(hardware only)* 259.
2307 Smartmodem 2400 . . . . . 429.
2308 Smartmodem 2400B *(w/Smartcom II)* 429.
2309 Smartmodem 2400B *(hardware only)* 399.

Hercules ... 2 years

2318 Graphics Card Plus. . . . . 189.
5120 VGA Card . . . . . 189.



Epson ... 1 year

LQ-510 Printer–Makes high quality 24 pin printing affordable. Includes push tractor and Epson's exclusive SmartPark paper handling features standard. 180 cps draft, 60 cps LQ (12 cpi mode) . . . . . $349.

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Intel ... 5 years

4696	2400B Internal Modem	$159.
2352	2400B Internal Modem 2 *(for PS/2)*	249.
5119	2400 Baud External Modem	179.
2346	Inboard 386/PC w/1 Meg	599.
4646	Inboard 386/PC Piggyback 4 Meg	1249.
2339	Inboard 386/AT *(req. inst. kit)*	859.
2338	Inboard 386/AT Installation Kit	139.
4266	Above Board Plus 512k	419.
4267	Above Board Plus I/O 512k	449.
5336	Above Board Plus 8 2 Meg	869.
5342	Above Board Plus 8 I/O 2 Meg	899.
4272	Above Board 2 Plus 512k	469.
4339	Above Board Plus Piggyback w/2 Meg *(upgrades to 6 Meg)*	call
4275	Connection Coprocessor	769.
4857	Visual Edge *(improve the output of your HP Laserjet II)*	449.
	MATH COPROCESSORS	
2375	8087 *(for IBM-PC & XT)*	89.
2374	8087-2 *(for 8 MHz 8088 CPU's)*	129.
2368	80287 *(for 6 MHz 80286 CPU's)*	135.
2370	80287-8 *(for 8 MHz 80286 CPU's)*	199.
2369	80287-10 *(for PS/2 Models 50 & 60)*	229.
4750	80387SX *(for 80386SX CPU's)*	309.
2371	80387 *(for 16 MHz 80386 CPU's)*	349.
2372	80387-20 *(for 20 MHz 80386 CPU's)*	399.
4121	80387-25 *(for 25 MHz 80386 CPU's)*	499.

Epson ... 1 year

LX-810 Printer–A high speed 9 pin printer perfect for the home, or as a second printer for the office. Includes SmartPark paper handling features. 180 cps draft, 30 cps NLQ (12 cpi mode) ..... $199.

Kensington Microware ... 1 year

2581	Masterpiece	94.
2582	Masterpiece Plus	109.
4972	PowerTree 10	19.
4973	PowerTree 20	27.
4974	PowerTree 50	54.
5697	Expert Mouse *(Trackball for PS/2)*	115.

Key tronic ... 3 years

2537	101 Keyboard	99.
4518	101 Plus Keyboard	99.

Kraft ... 5 years

2603	3 button Joystick	25.
4292	3 button Joystick w/game adapter	49.

KYE International ... lifetime

4127	Dyna Mouse GM6+ *(w/Dr. Halo III)*	49.
4675	GM6000 Mouse *(350-1050 dpi)*	59.

Intel ... 5 years

Inboard 386/PC–Gives new life to your aging PC or XT system with its 16Mhz 80386 processor and 1Mb of memory standard. Optional 1, 2, or 4Mb piggyback expansion available ..... $599.

Logitech ... limited lifetime

5464	Series 2 Mouse *(C9 for PS/2's)*	65.
4388	ClearCase Mouse *(serial only)*	69.
5151	HiREZ Mouse *(C9)*	85.
5152	Mouse w/Paint Show *(C9)*	99.
4297	ScanMan *(hand held scanner)*	185.

Magnavox ... 2 years

4758	13" CGA Monitor *(8CM515)*	269.
4760	13" Hi-Res Monitor *(9CMO53)*	369.
4761	13" VGA Monitor *(9CMO62)*	389.
4762	13" VGA Monitor *(9CMO82)*	449.

Microsoft ... lifetime

2870	Mach 20 *(1 year warranty)*	349.
2897	Mouse with Paintbrush	109.
2896	Mouse with Easy CAD	125.
2898	Mouse with Windows 286 2.1	139.

Mouse Systems ... lifetime

2812	OmniMouse *(serial only; 1 year wrty)*	39.
4306	PC Mouse II w/PC Paint+	89.

NEC ... 2 years

4799	Multisync 2A *(VGA Monitor)*	499.
5085	Multisync 3-D Monitor	699.

Orchid Technologies ... 4 years

3069	Tiny Turbo 286 *(accelerator board)*	219.
4765	Designer 800 VGA *(360 x 480)*	249.
4690	ProDesigner VGA *(800 x 600)*	310.

Pacific Rim ... 1 year

5010	1.2 Meg External *(for PS/2's)*	215.
5011	360k External 5¼" Drive	179.

PC Power & Cooling Sys. ... 1 yr

	REPLACEMENT POWER SUPPLIES	
3202	Turbo Cool 150 *(25° - 40° cooler)*	129.
3205	Turbo Cool 250 *(25° - 30° cooler)*	169.
3200	Silencer 150 *(84% noise reduction)*	115.
3201	Silencer 200 *(69% noise reduction)*	129.
4514	Turbo Cool 375	299.

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Practical Peripherals ... 5 years

3101	1200 Baud Internal Modem	$69.
3100	1200 Baud External Modem *(mini)*	77.
4149	P/Link *(extends par. print signal)*	109.
3097	Microbuffer Inline *(par. print buffer/32k)*	135.
3103	2400 Baud Internal Modem	139.
3102	2400 Baud External Modem	179.
5285	2400 Baud External MNP Modem *(Level 5)*	209.
4542	2400 Baud Internal Modem for PS/2	229.

Princeton Graphics ... 1 year

3166	Ultrasync *(800 x 600 max. res.)*	549.

Quadram ... 1 year

5143	JT-FAX 9600	549.

Safe Power Systems ... 2 years

4561	Safe 250W *(standby power bkup)*	249.
4562	Safe 425W *(standby power bkup)*	369.
4563	Safe 500W *(standby power bkup)*	495.

SOTA Technology ... 2 years

5107	Floppy Drive Controller *(S/P)*	99.
5109	SOTA VGA/16 *(with 256k)*	259.
5111	SOTA 286i-12 *(12 MHz accelerator)*	299.
5402	SOTA 386i-16 *(16 MHz accelerator)*	419.

Targus ... lifetime

4899	Nylon Laptop carrying case	55.
4901	Leather Laptop carrying case	139.

TheComplete PC ... 2 years

4889	TheComplete Hand Scanner 400	159.
5598	TheComplete Half Pg. Scanner 400	189.
4885	TheComplete Answering Machine	219.
4887	TheComplete FAX 9600	429.
5140	TheComplete Page Scanner	549.

Toshiba ... 1 year

3684	T1000 Laptop *(80C88, 6.4 lbs.)*	669.
3681	T1000 768k Memory Card	289.
4856	T3100E Laptop *(12 MHz, 20 Meg)*	2749.
4958	T1600 Laptop *(12 MHz, 20 Meg)*	3249.

Video 7 ... 5 years

3776	VEGA Deluxe *(supports 640x480)*	219.
3778	VEGA VGA	259.
4193	FastWrite VGA *(includes 256k)*	319.
4194	VRAM VGA *(includes 256k)*	469.

Kensington ... 1 year

Expert Mouse–Takes mouse technology a step further with its unique ergonomic design. Moving the ball instead of the whole mouse saves valuable desk space. Automatic acceleration gives smooth & effortless cursor control.. $115.

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DRIVES

IOMEGA ... 1 year

2485	Bernoulli II Single 20 Meg Internal	$767.
5116	Bernoulli II Single 44 Meg Internal	995.
2486	Bernoulli II Dual 20 Meg External	1659.
5117	Bernoulli II Dual 44 Meg External	1969.
4276	20 Meg Cartridge Tripak *(5¼")*	169.
5113	44 Meg Cartridge Tripak *(5¼")*	249.
	CONTROLLERS (required)	
2499	PC2 Card	169.
2500	PC2B Card *(bootable card for PC/XT/AT)*	229.
2502	PC4 Card *(for PS/2 Model 50/60/70/80)*	299.

Mountain Computer ... 1 year

2917	40 Meg Internal Tape Drive	379.
2915	40 Meg External Tape Drive	479.
2916	40 Meg External Tape Drive with Power Supply	569.
5378	60 Meg External Tape Drive with Power Supply	1169.
5616	150 Meg External Tape Drive with Power Supply	1495.
5499	80 Meg Internal Tape Drive	519.
5503	80 Meg External Tape Drive	629.
5190	40 Meg Data Cartridges *(pre-formatted)*	35.

Plus Development ... 2 years

3105	Hardcard 20 Meg *(49 ms)*	549.
3106	Hardcard 40 Meg *(28 ms)*	699.
5164	Impulse 40 Meg Int. Drive *(12 ms)*	659.
5165	Impulse 80 Meg Int. Drive *(12 ms)*	879.
5163	Impulse Controller *(required)*	229.

Seagate ... 1 year

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2285	20 Meg Internal Hard Drive ST225 *(w/controller and cables, 65 ms)*	289.
2286	30 Meg Internal Hard Drive ST238 *(w/controller and cables, 65 ms)*	299.
4554	40 Meg Int. HD ST251-1 (28 ms)	$359.
4624	80 Meg Int. HD ST4096 (28 ms)	619.

TEAC ... 1 year

4950	PC, XT 360k Drive *(5¼")*	79.
4951	720k Drive *(specify XT or AT, 3½")*	79.
4670	1.44 Meg Drive for XT *(3½")*	99.
4326	1.44 Meg Drive for AT *(includes Bastech software utilities, 3½" copy prot.)*	119.

Toshiba ... 1 year

3650	AT 360k Drive *(5¼")*	85.
3649	AT 1.2 Meg Drive *(5¼")*	99.
4755	AT 1.44 Meg Drive *(3½", includes Bastech software utilities)*	119.

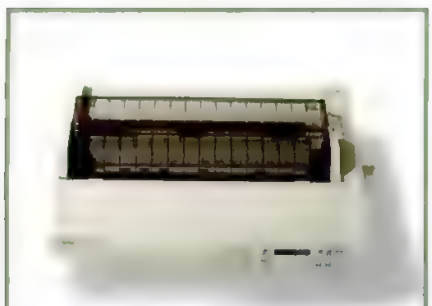
MISCELLANEOUS

CompuServe

1676	CompuServe Information Service	24.

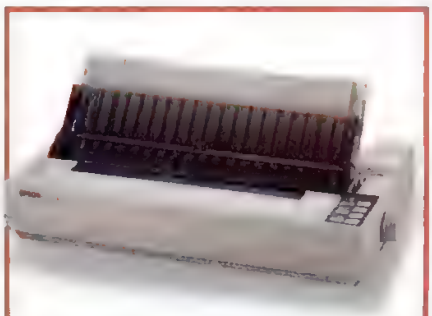
Cables ... lifetime

1019	Smartmodem-to-AT cable *(9 feet)*	15.
1050	Parallel Printer cable *(15 feet)*	19.



Epson ... 1 year

LQ-2550 Printer—A full-featured 24 pin, 136 column printer. Includes 7 built-in fonts, push tractor, and advanced paper handling. 333 cps draft, 111 cps LQ (12 cpi mode). **call**



Epson ... 1 year

FX-1050 Printer—Feature laden 136 column, 9 pin dot-matrix printer. SmartPark mode loads single sheets without removing continuous form paper. Prints 264 cps draft and 54 cps letter quality (12 cpi mode) ..... **call**

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All disks have a lifetime warranty.

5¼" DS/DD Disks *(360k)*

3291	Sony *(10 disks per box)*	12.
2789	Maxell MD2-D *(10 disks per box)*	13.
4192	Verbatim Datalife *(10 disks per box)*	13.

5¼" DS/High Density Disks *(1.2 Meg)*

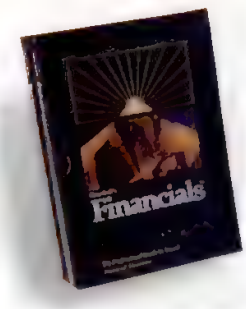
3770	Verbatim Datalife *(10 disks per box)*	19.
3292	Sony *(10 disks per box)*	19.
2790	Maxell MD2-HD *(10 disks per box)*	19.

3½" DS/DD Diskettes *(720k)*

3297	Sony *(10 disks per box)*	15.
3772	Verbatim *(10 disks per box)*	15.
2792	Maxell *(10 disks per box)*	16.

3½" DS/High-Density Diskettes *(1.44 Meg)*

3298	Sony *(10 disks per box)*	32.
3773	Verbatim *(10 disks per box)*	32.
2793	Maxell *(10 disks per box)*	32.



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3248	256k DRAMs *(120 nanosecond)*	call
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4366	1 Meg x 9 SIMMs *(100 nanosecond)*	call
5510	1 Meg x 9 SIMMs *(80 nanosecond)*	call
4705	1 Meg Chips *(100 nanosecond)*	call

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- 120 day limited warranty on all products.*
- To order, call us Monday through Friday 9:00 to 9:00, or Saturday 9:00 to 5:30. You can call our busness offices at 603/446-3383 Monday through Friday 9:00 to 5:30.

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Continental US:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, pay actual charges. Call for UPS 2nd-Day & Next-Day-Air.
- For all other items, add $3 per order to cover UPS Shipping. For such items, we automatically use UPS 2nd-Day-Air at no extra charge if you are more than 2 days from us by UPS ground.

Hawaii:

- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add $3 per order.

Alaska and outside Continental US:

- Call 603/446-3383 for information.

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PC Construction.

Using the old beam.
(Or, how we learned to log on.)

It takes a lot of lumber to run a computer mail order business here in the high rise hamlet of Marlow, NH (pop. 560). In fact, we recently started construction of a new sales and distribution center. Inspired by our well-built mascots, we've cleared ten acres, put in a new road, dug a pond, and are getting as much done as possible before winter. (At which time any tools you drop outside are lost until spring).

Fast stud service!

Admittedly, we've kept the local carpenters pretty busy since 1982, when we had them put some shelves in a closet to create our first warehouse. They've already restored the stately Christmas Tree Inn (c. 1833) to serve as our headquarters and conference center, rebuilt the dam out front, and even created a state-of-the-art TV production studio.

And what, you may ask, do all those sticks, stones, bricks, bracks, tongues and grooves rest upon?

An awful lot of concrete to tell the truth. But it sure helps to have a solid base of customers. So next time you're remodeling your micro, call us for the peripherals and programs. We'll make sure you don't get hammered on price. And we'll provide the toll-free technical support you need to make sure that everything's screwed on right and no wires are crossed. Plus, to keep you on the straight and narrow, we have a gift to help you follow all the rules. Read on!

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Business, like football, is often a game of inches. And the best way to make short work of your long shots is with your very own PC Connection Folding Ruler. Because it's the perfect tool for determining the long and the short of just about anything. You'll receive one free with any order of $500 or more between now and December 31.

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CLIP-ART TEST: OUR JETSET NEWSLETTER

by Stephanie K. Losee and Robin Raskin

One of the most likely uses for clip art is to illustrate a newsletter or similar document, combining both text and art. Thus one component of our testing script was to add a clip-art image to *PC Magazine*'s sample *PageMaker* document, Jetset. Our reviewers selected a map or cityscape symbol from their clip-art package and placed the image into the right side of the box labeled "Special Report." The process required the use of *PageMaker*'s Import or Place commands to incorporate the clip-art image.

Using *PageMaker*'s resizing tools to make the symbol fit the available space, reviewers noted any anomalies. For the most part, the packages handled the task well, some brilliantly. A few clip-art packages make the task of accurate miniaturization particularly difficult. *Harvard Graphics* images, when exported to an .EPS format, do not offer a bitmapped screen representation. Sizing a shaded gray box is considerably tougher than sizing an image.

Most notable was the wide variety and interpretation the packages offered in terms of a map or cityscape symbol. Predominant were skylines: some stark and simple, others richly detailed. Bitmapped images lost considerable detail and took on a fuzzy aura as they were miniaturized. Some of the highly complicated vector-based art suffered the same problem. Images that were clean and simple survived the test of downward sizing in the best shape. A good example comes from T/Maker's *ClickArt Series* (pictured): the image has enough special touches to attract interest, but its simplicity keeps the page from looking cluttered.

JETSET

June 1989 Your monthly guide to the best the world has to offer Vol 2 No 6

SHOPPING SPREE: THE LATEST FROM HONG KONG

BY TIM SMITH

This month, JET SET focuses on shopping in Asia. Our lead story, shopping strategies for Southeast Asia's busiest city, Hong Kong. Though any time is a good time to stroll the endless malls and arcades of Central and Kowloon, the moderate temperatures of autumn and winter make outdoor walking far more pleasant than it is during the sultry summer months. Remember, Hong Kong is at the same latitude as the Bahamas.

Smart shoppers start off at one of the vast, air-conditioned shopping centers to get a feel for prices before plunging into the more obscure areas to hunt bargains. Among the best choices is the Landmark on Hong Kong Island. Packed with hundreds of upscale boutiques, this is where you'll find a full selection of European designer clothing, handcrafted luggage, and leather goods. The

(Continues on page 2)

SPECIAL REPORT
10 city shopping outlook
Coverage begins on page 4.

In addition to the cityscape test, reviewers experimented with a variety of clip-art images and techniques. Using *PageMaker* as the target application, they imported a variety of images and experimented with sizing, cropping, overlaying, and image combining. The images were then output to the Apple LaserWriter. And those reviewers whose clip-art libraries were ancillary to drawing programs modified stock clip art in order to assess the editing and drawing tools of the parent graphics package. ■

This accessory contains a database of U.S. cities and states, allowing you to create custom maps through a series of pop-up menus. You can color-code the maps and add special symbols. If you've shied away from including maps because getting the one you want is a nuisance, you'll flip for this utility.

If *Harvard Graphics*' clip-art library were a wine, it would be more like the house red than a vintage claret. Its crudely colored, solidly filled images are acceptable for slides and overheads, but they simply aren't good enough for more-demanding applications like desktop publishing.

ImageFile

by Bruce Brown

Even persons with a dull appreciation for art can sense that the artwork in the Applied Microsystems *ImageFile* library is something special. With its extensive shading, shadowing, and highlighting, this complex artwork is strikingly realistic. And while *ImageFile*'s price ($495) is higher than that of other clip-art packages for *Freelance Plus*, the 305 pieces of bitmapped art that it offers have already been enhanced.

Based in Anchorage, Alaska, Applied Microsystems—a graphics design service company—discovered that many of its clients wanted fancier artwork than was available in most packages. The images in the package are in *Freelance Plus*'s .DRW format; each image comes both in black and white and with color optimized for output on a VideoShow film recorder. The black-and-white output files incorporate information that allows you to fine-tune them for Hewlett-Packard LaserJet printers, as well as for PostScript printers. Though the images thrive on PostScript's gray-scale support, they can produce results that are almost as good on the more popular and affordable LaserJet.

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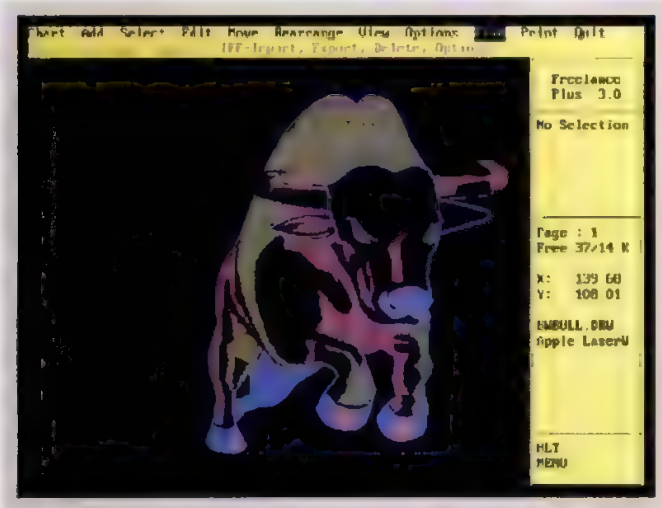
CIRCLE 540 ON READER SERVICE CARD



ImageFile's bitmapped graphics are quite complex, emphasizing realistic rather than symbolic images. The $495 price reflects the sophisticated nature of the artwork, but it's money well spent. This picture of a bull is from the collection of financial images.

Unlike companies that expect you to keep your clip art on floppy disks, Applied Microsystems assumes that you'll want to keep everything on your hard disk. Accordingly, the company is extremely conscious of the size of its files. The package comes with installation batch files that copy all of the files to separate subdirectories according to subject. Each set of six disks totals approximately 2.2MB, so even if you copy both the color and the black-and-white output files, the amount of space they occupy is not crippling.

PEERLESS DOCUMENTATION

Once the files are installed on your drive, you can retrieve them by calling them into *Freelance*. The images are terrific—so good that it's fun just to load them up and look at them. It's fair to use descriptions like *stunning*, *life-like*, and *impressive*, stopping just short of breathtaking (though the frontal image of a Porsche 911 got me going a bit).

If you can't take the excitement of seeing the images on-screen, you can peruse the image catalog in the excellent 265-page user manual, where you'll find all of the artwork arranged by category. The categories included are Backgrounds, Buildings, Communications and Technology, Fancy Text, Finance, Food Service, Icons, Industry, Medicine and Science, Military, People, Teamwork, Time, Training and Education, Transportation, and Word Chart Enhancers.

The manual also includes comprehensive sections on installing and using *ImageFile* with *Freelance*. It has separate tutorials on creating graphics for normal black-and-white output, for PostScript devices with gray-scale-reproduction ability, and for VideoShow. The amount of information included to help you optimize the images for specific output devices reflects the company's attention to detail. One of the most impressive sections of the manual is the one that "Sparks Your Imagination" with creative combinations of charts, text, and artwork.

Though *ImageFile* is designed for use with *Freelance Plus*, Applied Microsystems is tuning the images so that they can be used with other graphics programs and with word processing programs that can import graphics. At the moment, while you can convert *ImageFile*'s clip-art files to formats such as HPGL, .PIC, .CGM, .EPS, and TIFF using *Freelance*'s export facilities, you'll probably want to keep them in .DRW format if you can, so that you can fine-tune them for different output devices.

If you're a *Freelance Plus* user who has to create professional-quality charts and slides, *ImageFile* is a must-have product. If you're an artistic neophyte, the quality of the artwork and the manual can help to make you look very good indeed. And even if you're a talented designer and artist, you'll be impressed by the time you can save by using *ImageFile*.

ImageFile
Applied Microsystems, 200 West 34th Ave., #571, Anchorage, AK 99503; (800) 327-2588, (907) 563-1313 in Alaska
List Price: $495
Requires: 640K RAM; hard disk; *Lotus Freelance Plus*; Hercules, CGA, EGA, VGA, or MCGA video adapter; DOS 2.0 or later.
In Short: A striking collection of realistic, professional-quality art, *ImageFile* images look great on HP LaserJets as well as on more-expensive PostScript printers.

CIRCLE 415 ON READER SERVICE CARD

July 3, 1989

REPORT CARD — INFO WORLD

PC Illustration Software

	(InfoWorld weighting)	Adobe Illustrator Windows Version 1.0	Arts & Letters Graphic Editor 1.02	Corel Draw 1.01	GEM Artline 1.0	Micrografx Designer 2.0
List price		$695	$695	$495*	$495	$695
Performance						
Speed	(125)	Poor	Satisfactory	Very Good	Very Good	Very Good
Input/output	(125)	Good	Good	Very Good	Good	Excellent
Drawing/editing	(200)	Good	Good	Very Good	Satisfactory	Very Good
Documentation	(100)	Excellent	Good	Excellent	Satisfactory	Very Good
Ease of learning	(100)	Very Good	Good	Excellent	Good	Very Good
Ease of use	(100)	Satisfactory	Satisfactory	Very Good	Satisfactory	Good
Error handling	(75)	Good	Satisfactory	Good	Satisfactory	Good
Support						
Support policies	(50)	Satisfactory	Satisfactory	Good	Poor	Poor
Technical support	(50)	Good	Very Good	Very Good	Good	Good
Value	(75)	Poor	Satisfactory	Excellent	Good	Very Good
Final scores		**5.8**	**6.7**	**8.0**	**5.6**	**7.2**

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CIRCLE 729 ON READER SERVICE CARD

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SAMSUNG

CIRCLE 156 ON READER SERVICE CARD

Images with Impact

by Robert Kendall

3G Graphics Corp. arrived fairly recently on the clip-art scene. The company started out with two Encapsulated PostScript libraries for the Macintosh and has now ported these over to the PC. The company has yet to build up the sort of collection that can compete in terms of quantity with the major vendors. But what *Images with Impact* lacks in size, it makes up for in quality.

3G Graphics' $129.95 Business library and $99.95 Graphics & Symbols library (both are first volumes) together comprise about 275 black-and-white images, all in .EPS format. Both libraries reflect a well-developed sense of organization—something all too often lacking in clip-art packages. The artwork comes stored on floppy disks in subdirectories according to category, and each picture bears a filename that clearly describes its contents. A fold-out pamphlet for each library serves as a catalog.

With a small library such as this, judicious selection on the vendor's part is especially important. 3G Graphics comes out well on this score, offering a well-balanced mix of topics and styles.

The *Business* library contains the standard assortment of people in various office situations. Simple icons symbolize public services, transportation, finance, and politics. Especially attractive are stylized collages on geometric backgrounds representing occupations ranging from construction to media to medicine. There's a surprisingly comprehensive selection of computer images that depict in accurate detail everything from a PS/2 and a Macintosh SE to a VAX 8650. A nice complement of borders, dingbats, and headlines rounds out the library.

The *Graphics & Symbols* library assumes a lighter tone, offering such whimsical visual add-ons as mimes, balloons, and cartoon animals. The elegant representations of well-laid tables, trim-looking joggers, and other signs of the good life would make attractive adornments for advertising copy. There are also stylized icons of people, buildings, vehicles, and miscellaneous objects, all suitable for dressing up a graph.

Most drawings are stored in their own files, but a number of files contain several related images. These appear side by side, making it easy to use the cropping tool of a desktop publishing package to cut out all but the one you want.

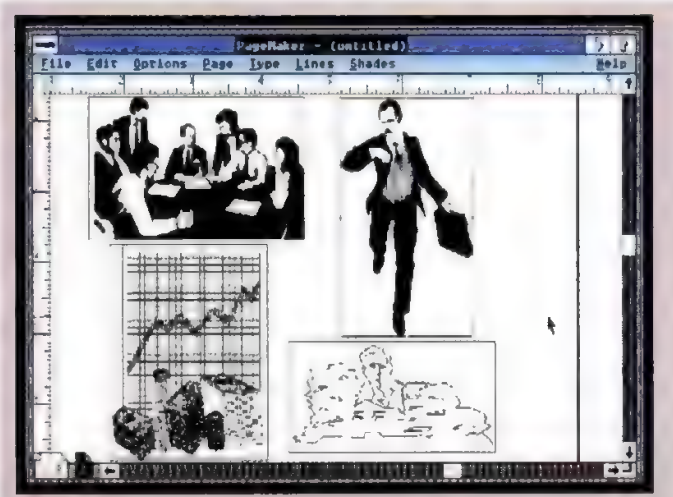
Users of *Adobe Illustrator*, *Corel Draw!*, and other graphics packages that can edit .EPS files will appreciate the way 3G Graphics has created its images. Items in a picture often correspond to discrete graphics objects, so you can easily break up a complex image and rearrange it. For example, you can snatch a glass off a table or a floppy disk out of someone's hand. In fact, by cannibalizing larger pictures, you can effectively increase the number of symbols at your disposal.

Each library comes with an illustrated booklet of useful tips on editing graphical images and using them effectively in newsletters, fliers, logos, presentations, and the like. The booklet we received with the *Graphics & Symbols* library is actually intended for 3G's Macintosh version of the package, but nearly all of the information applies equally well to PC users. At review time, 3G was working on a PC version of this manual.

FACT FILE

Images with Impact
3G Graphics Corp.,
11410 NE 124th St.,
#6155, Kirkland, WA
98034; (800) 456-0234,
(206) 823-8198.
List Price: Business,
volume 1, $129 95;
Graphics & Symbols,
volume 1, $99.95.
Requires: Hardware and DOS requirements depend on graphics program used.
In Short: 3G Graphics offers a small but well-organized and varied assortment of clip art. All images are in .EPS format and produce high-quality printouts.

CIRCLE 418 ON READER SERVICE CARD



3G Graphics Corp.'s *Images with Impact* offers high-quality object-oriented black-and-white images that are easy to manipulate. The money image and line drawing may look pretty messy on-screen, but the printouts are another story.

A bitmapped image is attached to each .EPS file so that you can see what the artwork looks like when you use a program such as *PageMaker* to place it in a document. The *Images with Impact* that we printed out from *PageMaker* did indeed make an impact with their crispness and clarity.

The main limitations of *Images with Impact* are the relatively small number of pictures available and the lack of a format other than .EPS. This situation should improve with time; in fact, 3G Graphics plans to release a third library soon, consisting mainly of borders and other such design-related elements. Then again, if you have a PostScript printer and don't want more than a small collection of clip art, this well-organized, thoughtfully prepared selection of high-quality work may be for you.

Metro ImageBase

by Robert Kendall

Metro Creative Graphics, the parent company of Metro ImageBase, bills itself as the largest supplier of camera-ready clip art in the U.S. Since its inception in 1910, the company has amassed a gargantuan library of over a million images, and it currently services most of the country's major newspapers. Now PC users can tap into this voluminous graphics reservoir, thanks to the release of *Metro ImageBase*.

Metro has created 14 different on-disk libraries by scanning selections from its clip-art holdings and then touching up the images with a paint program. Each $145 library contains 100 images and is available in either TIFF or .PCX format. For the benefit of *WordPerfect* users, Metro also offers the clip art as .IMG files converted from the .PCX images.

The TIFF-format files we tested produced printed images of outstanding quality, largely because of their top-level 300-dot-per-inch resolution. Even when enlarged by 50 or 100 percent, the pictures rarely displayed jagged edges. Furthermore, the images take advantage of the complex and subtle shading that is possible when you have control over each pixel. Of course, the bitmapped format has its limits: you can't blow the images up to several times their original size without sacrificing quality.

FACT FILE

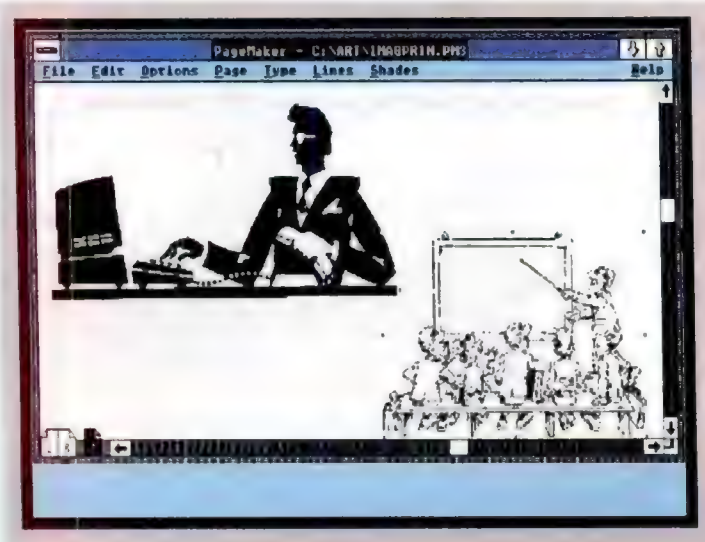
Metro ImageBase
Metro ImageBase Inc., 18623 Ventura Blvd., #210, Tarzana, CA 91356; (800) 525-1552.
List Price: $145 per volume (volumes are NewsletterMaker, the Four Seasons, Exercise & Fitness, Weekend Sports, Team Sports, Business Graphics, ReportMaker, Nine to Five, Computers & Technology, Art Deco, Borders & Boxes, Food, People, Travel). Available in TIFF, .PCX, or .IMG formats.
Requires: Any graphics program accepting TIFF, .PCX, or .IMG files; file decompression utility requires 128K RAM, hard disk, and DOS 3.1. Additional RAM, DOS, and graphics card requirements depend on graphics program used.
In Short: *Metro ImageBase* is full of highly detailed and consistently attractive illustrations that produce quality high-resolution printed output. The collection contains very few simple depictions of objects, however, and no dingbats or schematic symbols. File compression and poor organization make the images rather inconvenient to use.

CIRCLE 417 ON READER SERVICE CARD

HUNGRY FOR SPACE

Unfortunately, these high-resolution files are not modest in their needs for disk space. To restrict the libraries to a manageable number of disks, Metro supplies them in compressed format, giving you PKWare's *PKXARC* archiving program to extract each image into its own file. You can extract images one at a time or all at once, but you'll undoubtedly want to extract files only as you need them, because decompressing just one library will fill up an entire 30MB hard disk.

File compression is a logical option for dealing with such vast quantities of material. But it's a nuisance, and Metro has made it much more cumbersome than it should



Metro ImageBase is full of detailed high-resolution bitmapped images. Some selections from the Business Graphics library are shown here; even the line drawing is well represented on-screen, although a few of the curves are missing.

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be. To restore a picture, you must type its filename into a command string at the DOS prompt. The filenames are unnecessarily long serial numbers that reflect neither the library that the images are in, nor the order in which they appear in the printed catalog (they are the catalog numbers of the images in Metro's full collection). To complicate matters further, the *Metro ImageBase* catalog does not list the images according to the disk they're stored on.

ILLUSTRATIONS PREFERRED

The artistic quality of the pictures is high and nearly all are quite detailed, but the emphasis is on illustrations rather than symbols. The libraries contain relatively few simple renderings of objects such as would be suitable for adorning graphs. You won't find architectural, engineering, or flow-charting symbols, and there are no dingbats or other typographical embellishments. However, *Metro ImageBase* does include an excellent and varied library of borders.

The libraries span a broad range of subject matter, encompassing business, travel, food, sports, technology, health, and more. A unique addition is the Art Deco library, which contains images from the 1920s and 1930s culled primarily from period advertisements. The style of the drawings varies throughout the libraries, but there is a preponderance of realistically rendered people smilingly engaged in various activities. A sprinkling of cartoon images helps to add variety.

Metro has plans to bring out over 30 additional disk-based libraries covering such diverse areas as American history, the classroom, dinosaurs, the 1950s, law, monsters, music, and space. These will be welcome additions to this library of consistently attractive high-resolution images.

Micrografx ClipArt Libraries

by Robert Kendall

Micrografx's thriving family of graphics applications for *Microsoft Windows* has made it a dominant force in that marketplace. It's not surprising, then, that the *Micrografx ClipArt Libraries* should also be standouts.

Micrografx markets 24 different clip-art libraries, each with 100 to 200 images. You can pick them up separately for $79.95 a package or bundled together in four different $249 collections. The entire collection totals nearly 3,000 pictures on 40 disks, enough to satisfy the needs of just about anyone. All of the libraries are logically organized, and each is accompanied by a printed catalog. Descriptive filenames make it relatively easy to find what you need.

Each library comes with a copy of *Micrografx Portfolio,* a simple *Windows* application for viewing, printing, and exporting the images. Once you've called up a clip-art file (each of which contains a screenful of images), you can zoom in on a selected area and print the on-screen view. Alternatively, you can select any single image and save it as a separate file—a *Micrografx* .DRW or .PIC file or a *Windows* Metafile. Of course, you can use the *Windows* clipboard to cut and paste images directly from *Portfolio* to other *Windows* applications, such as *PageMaker*.

The packages we received for review came with the 2-year-old Version 1.0 of *Portfolio*, which contained no *Windows* Metafile export option and had a tendency to crash the system. When Micrografx sent us the current version of the program, these problems were rectified.

INFINITE VARIETY

In the Micrografx libraries, you'll find depictions of just about every item under the sun, and not just one or two generic images to represent each category. For example, the two-dozen-plus car illustrations run the gamut from Grand Prix racers to a stretch limo to a VW bug. And the variety is equally good if you want to go by plane, boat, or spacecraft. This encyclopedic coverage extends to grocery store items, tools, computers and peripherals—even flags and road signs. And you can take advantage of the Business Forms library to create customized form templates.

Along with the standard business themes, such areas as sports, holidays, an-

Many of the more-complex object-oriented images in the *Micrografx ClipArt Libraries* make good use of color and various fill patterns. Unfortunately, the colored figure of a woman at a computer prints very poorly in black and white.

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FACT FILE

Micrografx ClipArt Libraries
Micrografx Inc., 1303 East Arapaho Rd., Richardson, TX 75081; (800) 272-3729.
List Price: Standard Edition Collections (Business, Personal, Publishing, and Technical; each comprises several Standard Edition Libraries), $249 each; Standard Edition Libraries (Computers/Office; Business Forms; Flags; Merchandising; Signs; Holiday; People, Places & Things; Sports & Recreation; Space/Zodiac; Transportation; Borders; Dingbats; Headline Typefaces Volumes I-V; Architectural; Chemical; Electrical; Medical; Military; Religious; and Cartoons), $79.95 each; Special Edition Collections (Anatomy, U.S. Maps, and World Maps require *Micrografx Designer*), $149.95 each.
Requires: 512K RAM (640K recommended); hard disk; *Microsoft Windows* (any version); mouse; Hercules, CGA, EGA, or VGA graphics adapter; DOS 2.0 or later.
In Short: This encyclopedic collection of bitmapped art is well organized and comes with excellent *Windows*-based software for viewing and exporting the images. Though a little bit artistically bland, the pictures are quite good in the technical details of their execution.

CIRCLE 418 ON READER SERVICE CARD

imals, and the military are generously represented. The Publishing collection contains a cornucopia of borders, dingbats, arrows, and other basic symbols. There are also two dozen ornamental fonts from which you can construct simple headlines by treating each letter of the alphabet as a separate piece of clip art. The Technical Collection should be a real boon to architects, chemists, and electrical or mechanical engineers, with file after file of the schematic symbols used in these lines of work.

If you want anatomical images or maps, you must turn to the Special Edition Collections. These images require *Micrografx Designer* because they are so complex that you cannot put them to practical use until you've extracted the portions you want to work with.

BREAD AND BUTTER

Its methodically thorough approach is what sets the *Micrografx ClipArt* series apart from the competition, but it is also, in a sense, its biggest limitation. Taken as a whole, the entire gallery has a homogeneous character, one that rarely departs from no-nonsense, realistic drawings and simple, stylized icons. (The Cartoons library might have livened up the tone, but Micrografx failed to supply a copy for this review.)

If you have a graphics program that can edit Micrografx files, you will appreciate the detailed structure of the images, which gives you a broad range of options for manipulating them. Many of the images, such as the flags and some of the more-complex pictures of people, make use of different colors and fill patterns, a boon if you want to use a color printer. But this level of detail causes the pictures to take an inordinately long time to display on-screen. And much of their carefully articulated shading, though easily visible on-screen, is rendered as a solid mass of black on monochrome printers. The simpler line drawings produce crisp, clear images.

Few users will be unable to find what they need somewhere among Micrografx's extensive clip-art offerings. These well-organized, high-quality libraries also come with reasonable price tags.

PicturePak

by Robert Kendall

In addition to the quality of the images themselves, one of the things that distinguishes a good clip-art library is its versatility. Marketing Graphics Inc. (MGI) seems well aware of this. Even though its *PicturePak* series, each edition of which costs $145, is aimed at business users, the collection should prove adaptable to a wide range of needs.

At review time, 3 *PicturePak* libraries with a total of 565 black-and-white bitmapped images were available: Executive and Management, Sales and Marketing, and Finance and Administration. (The three can be purchased together for $350.) By the time you read this, a Federal Government library and a State and Local Government library will have joined the collection. In addition, the company offers special libraries for use with Lotus's *Freelance*, General Parametrics' VideoShow, Brightbill-Roberts's *Show Partner*, and IBM's *Storyboard*.

Each *PicturePak* library supplies both .CGM and .PCX versions of its pictures. The vector-format .CGM files produce very-high-quality printed images no matter how much you resize them. Because of the limitations of their bitmapped format, the .PCX images can't compete in print

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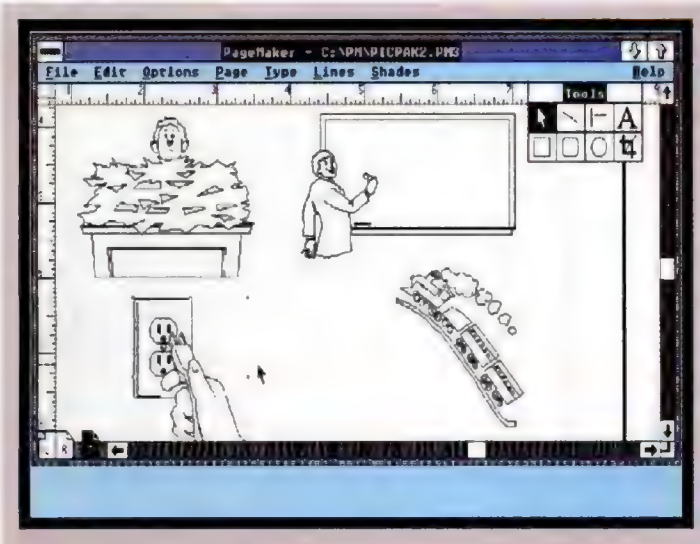
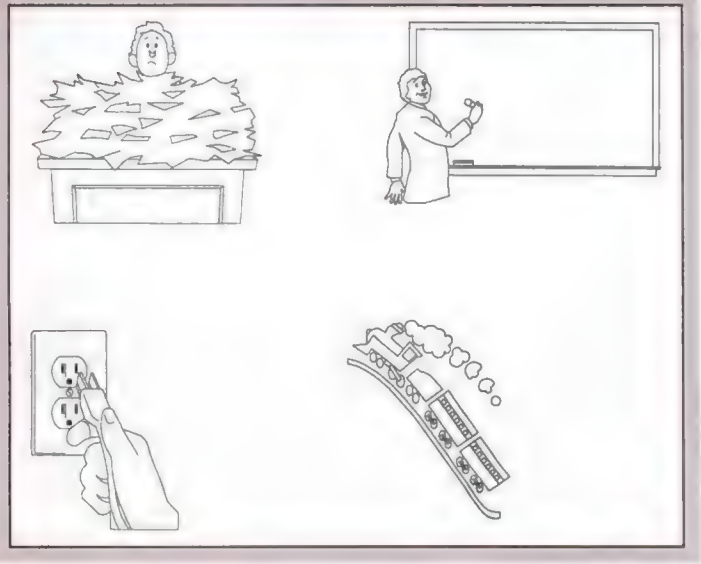


The bitmapped images in *PicturePak* range from the whimsical to the serious. You must import them into an application such as *PageMaker* in order to view or print them.



artwork can detract from more important elements of a document.

In the scope of its subject matter, *PicturePak* is quite broad, especially in the areas of money, office settings and paraphernalia, communications, and travel. But you'll find few of the standard images relating to heavy industry, medicine, or holidays.

One of *PicturePak*'s greatest strengths is its large and imaginative collection of backgrounds and borders. These include a newspaper with space for your own front-page text, an airplane pulling a blank banner, and cartoon-like "balloons" emerging from such things as a cannon or an Indian signal fire. Another unique feature is the assortment of allegorical images that apply to common business situations. Besides numerous sports images representing success and competition, you'll find a checkmate position, the "little engine that could," and a carrot dangling before a donkey.

One of *PicturePak*'s greatest strengths is its large and imaginative collection of backgrounds and borders.

The collection often offers several different representations of the same thing in varying degrees of stylization—from the relatively naturalistic to the merely symbolic. The tone of the collection also runs the gamut, from whimsical cartoon figures to more-businesslike depictions. This diversity does much to enhance the package's versatility.

PicturePak offers a carefully selected and organized assortment of quality illustrations. The package is especially well suited to business-related documents, yet these simple but telling images have much broader applications as well. It is a testament to the versatility of these images that WordPerfect Corp. has chosen to include a selection of them with *WordPerfect* 5.0.

quality and come out looking rather rough around the edges. But if you wish to bring the files into a paint program or to append them to scanned images, you'll appreciate this option.

MGI offers no way to view or edit the pictures, but both formats are supported by a wide variety of drawing and paint programs. The images are clearly organized by subcategory within each library, with one picture to a file. An illustrated catalog makes it easy to find whatever you want on-disk.

SIMPLICITY IS THE KEY

Most of the images take the form of either simple line drawings or silhouettes. Although the artwork is less detailed than that offered by some other vendors, it is always executed with flair and elegance. Indeed, the concise quality of the work is one of its greatest strengths, for excessively busy

FACT FILE

PicturePak
Marketing Graphics Inc., 4401 Dominion Blvd., Glen Allen, VA 23060; (800) 368-3773, (804) 747-6991.
List Price: $145 per edition (Executive and Management, Sales and Marketing, and Finance and Administration); $350 per set of three editions (each edition contains both .CGM and .PCX file formats).
Requires: Any graphics program that accepts .CGM or .PCX file formats. RAM, disk, DOS, and printer requirements depend on graphics package used.
In Short: These well-organized libraries are notable for their simple and attractive images and their careful selection. The use of standard bitmapped and vector file formats makes them suitable for a wide range of applications.

CIRCLE 419 ON READER SERVICE CARD

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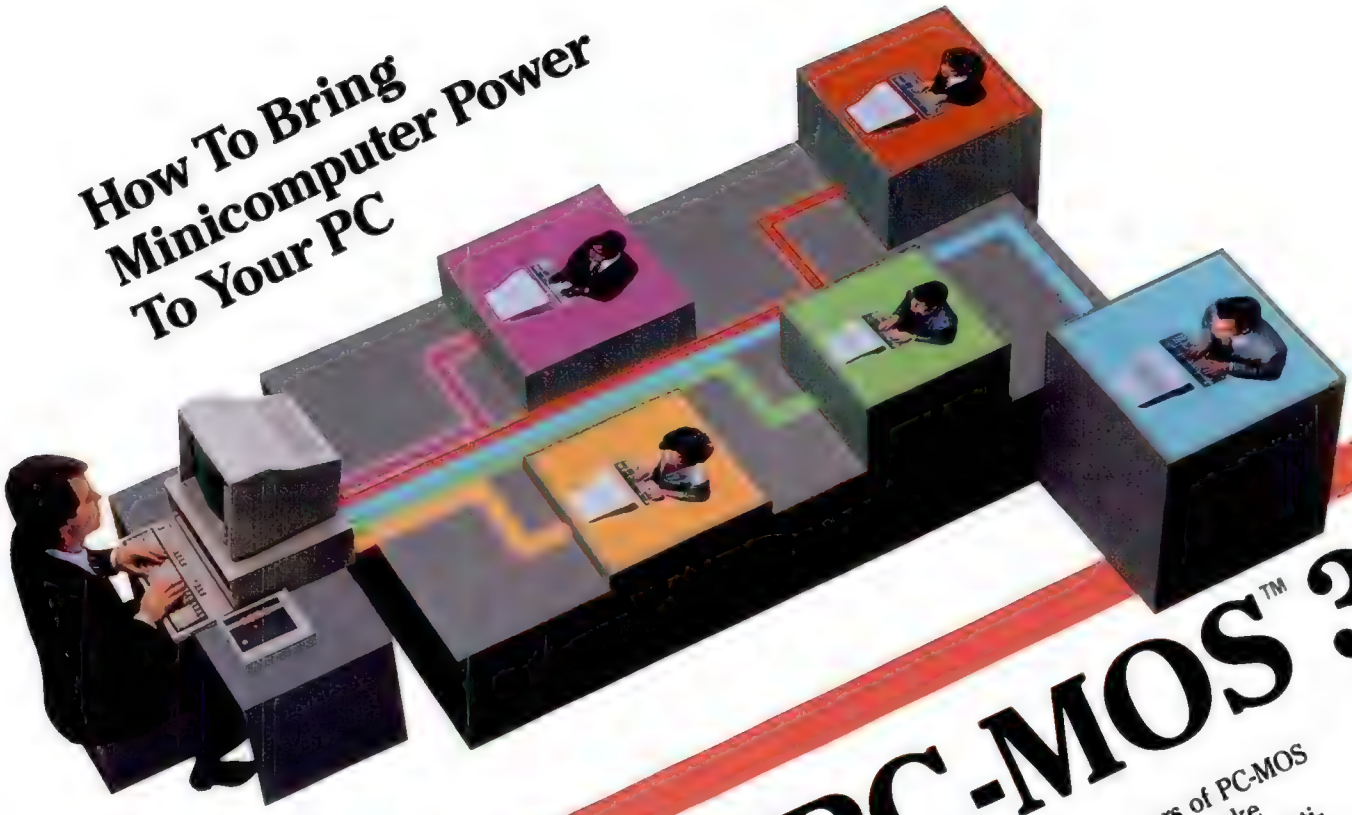
How To Bring Minicomputer Power To Your PC



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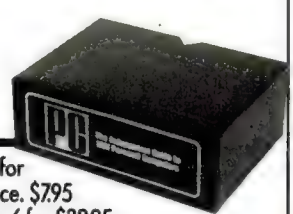

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Presentation Task Force

by Robert Kendall

New Vision Technologies started out producing clip art for General Parametrics' VideoShow products. Now it has extended its reach to the large base of Lotus *Freelance Plus* users with *Presentation Task Force*, a $349 clip-art library that uses *Freelance Plus*'s proprietary .DRW format and optimizes its output device support.

Although *Freelance Plus* comes with its own clip-art library of over 700 images, the illustrations are mostly simple line drawings, and some important topics, such as people, are poorly represented. *Freelance* users should therefore welcome the *Presentation Task Force* library, which offers 1,250 high-quality color images for output on printers and film recorders. Since these images contain layered objects that won't print properly on plotters, New Vision also offers simplified monochrome versions for plotters of 450 of these pictures.

New Vision has gone to great lengths to ensure that its *Freelance* clip art prints out the way it should whether you're using a color output device, a gray-scale PostScript printer, or a black-and-white printer. The company markets a new color palette for installation in *Freelance Plus*, and the manual includes a table for each output device supported by *Freelance* that demonstrates how to set the colors in the Freelance Output Options form for optimum results.

FACT FILE

***Presentation Task Force*, Version 1.0**
New Vision Technologies Inc., Box 5486, Stn. F, Ottawa, Ontario, Canada K2C 3M1; (613) 727-8184.
List Price: *Freelance* version, $349; .CGM version, $199.
Requires: *Lotus Freelance Plus* version requires 640K RAM, hard disk, graphics card and monitor, DOS 2.1 or later.
In Short: *Presentation Task Force* is a large, diverse library of attractive color clip art that's especially well suited to presentation graphics.

CIRCLE 420 ON READER SERVICE CARD

This system requires some initial setup time but means that the colors you see onscreen should match the colors you get from your color output device as closely as possible. Monochrome output should also accurately preserve outlines and differences of shading, avoiding the fuzziness that can occur when you print color images on a monochrome device. The output is crisp and won't disappoint.

The library covers most of the standard categories fairly thoroughly but is clearly targeted toward business presentations. You'll find few of the standard images of advertising art, such as elegant representations of dining, vacationing, or seasonal fare.

***Presentation Task Force* covers most standard categories fairly thoroughly but is clearly targeted toward business presentations.**

There's an especially broad selection of people, encompassing businessmen and women, scientists, doctors, soldiers, and a wide variety of other professions. The library is also notable for a series of cartoon images embodying various business themes and metaphors. For example, men in business suits are depicted as mountain climbers struggling toward the summit of success or as athletes running the bases or fumbling the ball (some may object to the complete exclusion of women from this series).

Most of the other images are much less elaborate than the people or cartoons. Numerous simple images—often highly stylized or in silhouette—depict aspects of industry, finance, transportation, government, sports, and technology. There's also a good selection of food and animals and a

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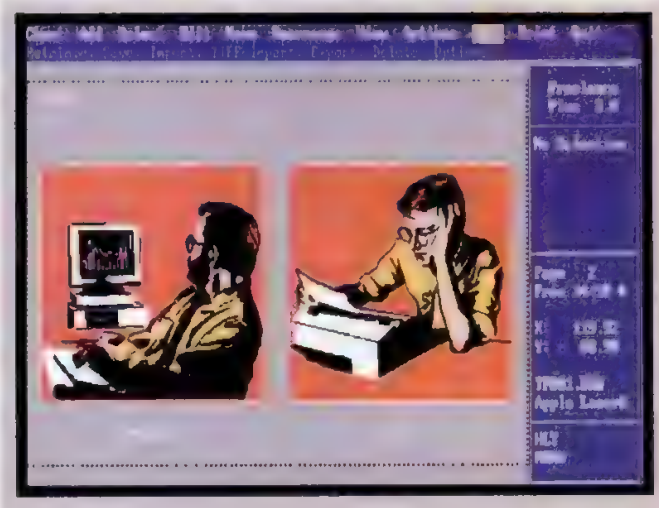


These object-oriented color images belong to *Presentation Task Force* and are displayed here in Lotus's *Freelance Plus*. Some of the images in this package can also be found in *CorelDraw!*, which bundles third-party clip art with its drawing program.

The broad range of icons makes *Presentation Task Force* especially well suited to presentation graphics.

wealth of geographical material, including maps of all 50 states and maps and flags of several foreign countries. A generous assortment of borders, backgrounds, arrows, and bullets should go a long way toward enhancing text.

A logically organized 260-page catalog accompanies the library. The detailed table of contents makes tracking down images easy. But, since the filenames consist of code numbers rather than descriptions of the files' contents, you'll have to rely exclusively on the catalog to find what you want. The *Presentation Task Force* manual includes useful instructions on how to retrieve and edit the clip art with *Freelance* and even contains tips for creating good presentations.

The images themselves are stored two or more to a file, which saves disk space. And because of the way *Freelance* retrieves clip art, this doesn't make the images any more difficult to use than pictures stored one to a file. If you retrieve a file into the page 2 screen of *Freelance*, you can select the image you want by pressing the appropriate Alt-key combination and then automatically adding the image to page 1.

MGI also expects to offer a smaller version of *Presentation Task Force* in .CGM format, but that version was not available at review time. The .CGM library is expected to cost $199 and consist of 450 images selected from the *Freelance* edition. All of these images will come in a monochrome form suitable for black-and-white printers and plotters, with 350 also included in a second, color version.

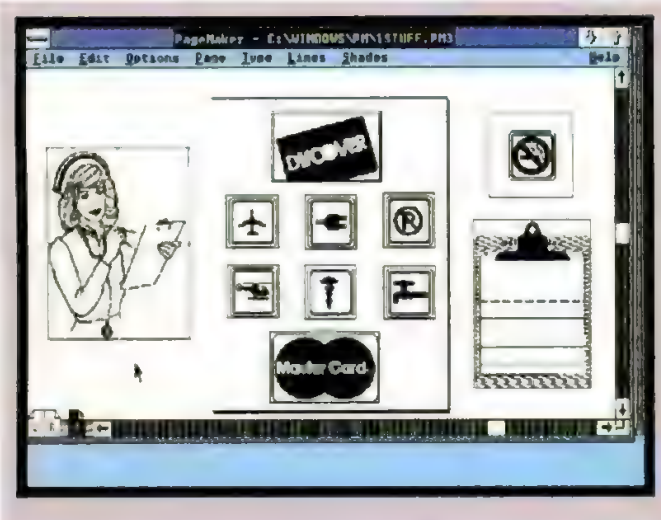
The *Presentation Task Force* for *Freelance* is a diverse collection of quality material. The broad range of simple icons and stylized representations makes it especially well suited to presentation graphics. The excellent use of color and the careful attention to output devices is a strong plus for anyone creating the slides and color printouts that today's business presentations increasingly demand.

ProArt Professional Art Library

by Alan Cohen

ProArt Professional Art Library, from Multi-Ad Services, won't dazzle you with fancy, state-of-the-art features. It simply offers disk after disk of clip-art images in Encapsulated PostScript (.EPS) format. Like a high-tech black-and-white version of Colorforms, it lets you pick and choose whatever images you want to use, then loads them into your graphics program or desktop publishing package.

Three *ProArt* libraries are currently available: the Business collection, the Holiday collection, and the Sports collection. The libraries cost $139 each and $375 as a group of three (the group package is



ProArt Professional Art Library's Business Collection offers variety not only in types of images but also in styles—you'll find people, objects, logos, and symbols that are sleek or detailed, depending on their expected use.

available on floppy disk or CD-ROM). For the most part, the images are lively and professional-looking. By far the most interesting and useful of the three packages is the Business library. At first glance this collection may not seem too impressive. Compared with other clip art packages, there aren't all that many images—just over 130. (For comparison, Micrografx's Business collection contains over 400 pieces of clip art.) And the images are broken up into so many categories that there is not much variety within specific subjects—if you want an image of a nurse or a bridge, you have just one picture of each.

But the images are well done (some rank among the best we've seen), so if you value quality over quantity, *ProArt* shouldn't disappoint. The use of PostScript eliminates jagged edges and gives every printout a truly professional look, provided that you work with a PostScript-compatible printer. (Use a non-PostScript printer and you can forget about those smooth curves.)

Furthermore, the categories are well thought out. The Logo directory, for example, contains graphical representations of most major credit cards. Many businesses, especially restaurants and shops, should find these images invaluable when printing up fliers or newsletters. And the Symbols directory, composed of 35 simple pictorial representations of common objects and messages—such as "No smoking" or "Telephone"—is cleverly arranged.

ProArt also takes the difficulty out of finding and loading the right piece of art. Every image has a filename that makes sense; there are no code numbers to look up. An excellent, easy-to-use Pictorial Index accompanies each collection, along with a short guide to getting started if you're using *ProArt* with *PageMaker*, *Ventura Publisher*, or any of a half dozen other programs. The fact that the documentation is so scanty would hardly be a reason to discount *ProArt* as a viable clip art option. It has almost no functions of its own anyway.

Because *ProArt* supplies only the art, you'll have to use your own graphics application if you want to crop or size the images on your screen. Serious *ProArt* users will want to consider purchasing *Adobe Illustrator* or another drawing program that will allow you to edit the .EPS-format images.

Considering how few images you get

ProArt Professional Art Library
Multi-Ad Services Inc., 1720 W. Detweiller Dr., Peoria, Il 61615; (800) 447-1950, (800) 322-3941 in Ill.
List Price: Business Collection, Holiday Collection, Sports Collection, $139 each If purchased together, $375 for either floppy disk or CD-ROM version
Requires: Any graphics application accepting .EPS-format files. RAM, disk, and DOS requirements dependent upon graphics package used. PostScript printer strongly recommended.
In Short: A thoughtfully designed package that stresses quality over quantity. You'll especially like the professional-looking credit-card images.

CIRCLE 421 ON READER SERVICE CARD

EDITOR'S CHOICE

A Matter of Taste

No one clip-art package will satisfy all needs, not to mention all tastes. These packages were obviously created by talented artists, each possessing imagination and a highly evolved sense of style. While no single package walks away with the Editor's Choice, there are certainly some winners on a number of different criteria.

Bitmapped .PCX images such as those in T/Maker's *ClickArt Series* are perfect for community newsletters. These libraries are inexpensive and have a folksy "painted" look that's radically different from the clean lines and curves of object-oriented art.

Professionals will surely demand vector-based art in .EPS format. Vector art looks good scaled to any size and output to any device—and can be accepted by most drawing and desktop publishing programs.

Style is a matter of intent, as well as audience. Marketing Graphics' *PicturePak* contains scads of conventional borders, embellishments, and icons that any business executive would covet. By contrast, the complex and riveting clip art from *ArtRight Image Portfolios* belongs in the highly stylized world of graphics design, not in a business presentation.

Color is another consideration. Multicolor clip art, when output to the black-and-white page, loses its detail unless it's very well executed. Black-and-white clip art is difficult to colorize because nonclosed shapes cannot have color fills. The best bet for those who frequently straddle the worlds of monochrome and color is *Presentation Task Force;* all of the program's images are supplied in both color and black and white.

If hassle-free image search is your priority, then 3G Graphics Corp.'s *Images with Impact* is the clear leader. Although its clip-art selection is not as large as some others, the images are intelligently housed in appropriate subdirectories with crystal-clear descriptive file-naming conventions.

Our inclination is to choose a clip-art package that dovetails with top-notch drawing tools since clip art, in its highest incarnation, can be a design springboard rather than the final product. *Corel Draw!*, the hottest new program in town, boasts the hottest new clip-art marketing technique, as well. The company bundles a clip-art sampler with snippets from key vendors—2 at this writing, 12 by the time this issue hits the newsstands. Hands down, it's the best way to become educated about the various styles of clip art.

Arts & Letters Graphics Editor, a vintage purveyor of clip art, is a best bet for those with a utilitarian bent. You're bound to find something that suits your needs, and once you do, it's a pleasure to customize the art with the program's superb drawing tools.

Micrografx churns out voluminous libraries and serves a variety of special-interest groups (scientists, engineers, architects) better than anyone. And finally, if you're looking for the most designs for your dollar and the assurance that one vendor can supply all of your basic clip-art needs, the answer is *Metro ImageBase;* this package offers quantity without sacrificing quality.

for $139 (or even $375), *ProArt's* cost per image is by no means the cheapest. But while *ProArt* may not have a great abundance of images, its images are both useful and well organized. PostScript-equipped desktop publishers will find the *ProArt Professional Art Library* package a worthwhile starter. ■

Bruce Brown is a frequent contributor to PC Magazine. *Alan Cohen is an editorial assistant at* PC Magazine. *Robert Kendall is a New Jersey–based freelance writer and editor who specializes in computers. Robin Raskin and Luisa Simone are contributing editors of* PC Magazine.

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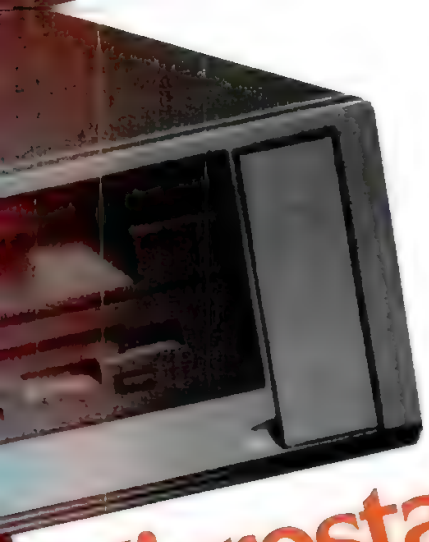

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Std. Hard Drive Capacity	20 Mbyte		32 Mbyte RLL	
Hard Drive Type	IDE Built-In		Can use - RLL, MFM, IDE, ESDI	
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Software	Diagnostic		On-Line Help, MS-DOS	
Space Saver Case	15"W, 15"L, 4"H		14.5"W, 16.5"L, 5.5"H	
Moneyback Period	30 Days		30 Days	
Warranty	1 Yr. Parts & Labor		1 Yr. Parts & Labor	
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*Jerry Pournelle holds a doctorate in psychology and is a science fiction writer who also earns a comfortable living writing about computers present and future.

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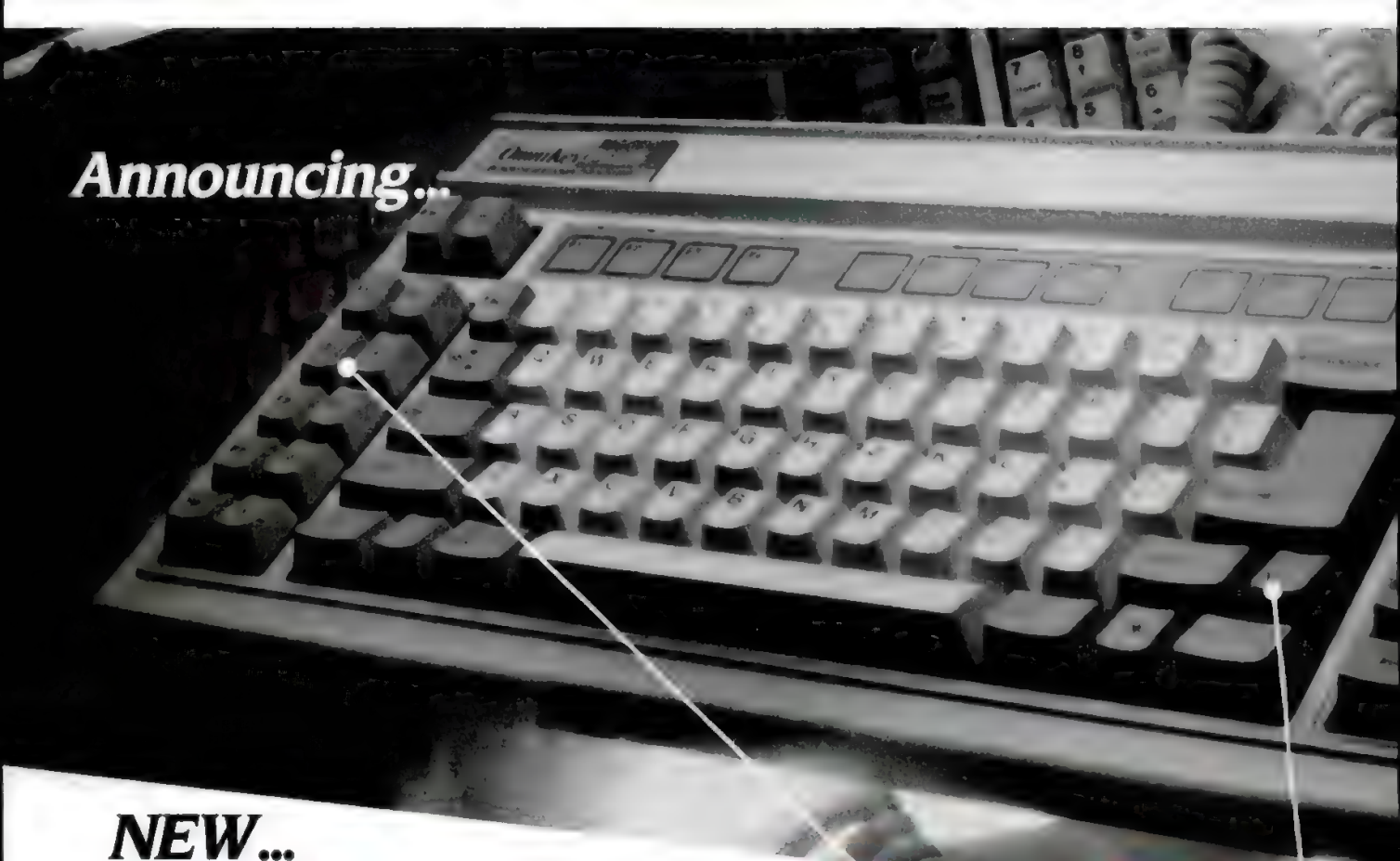

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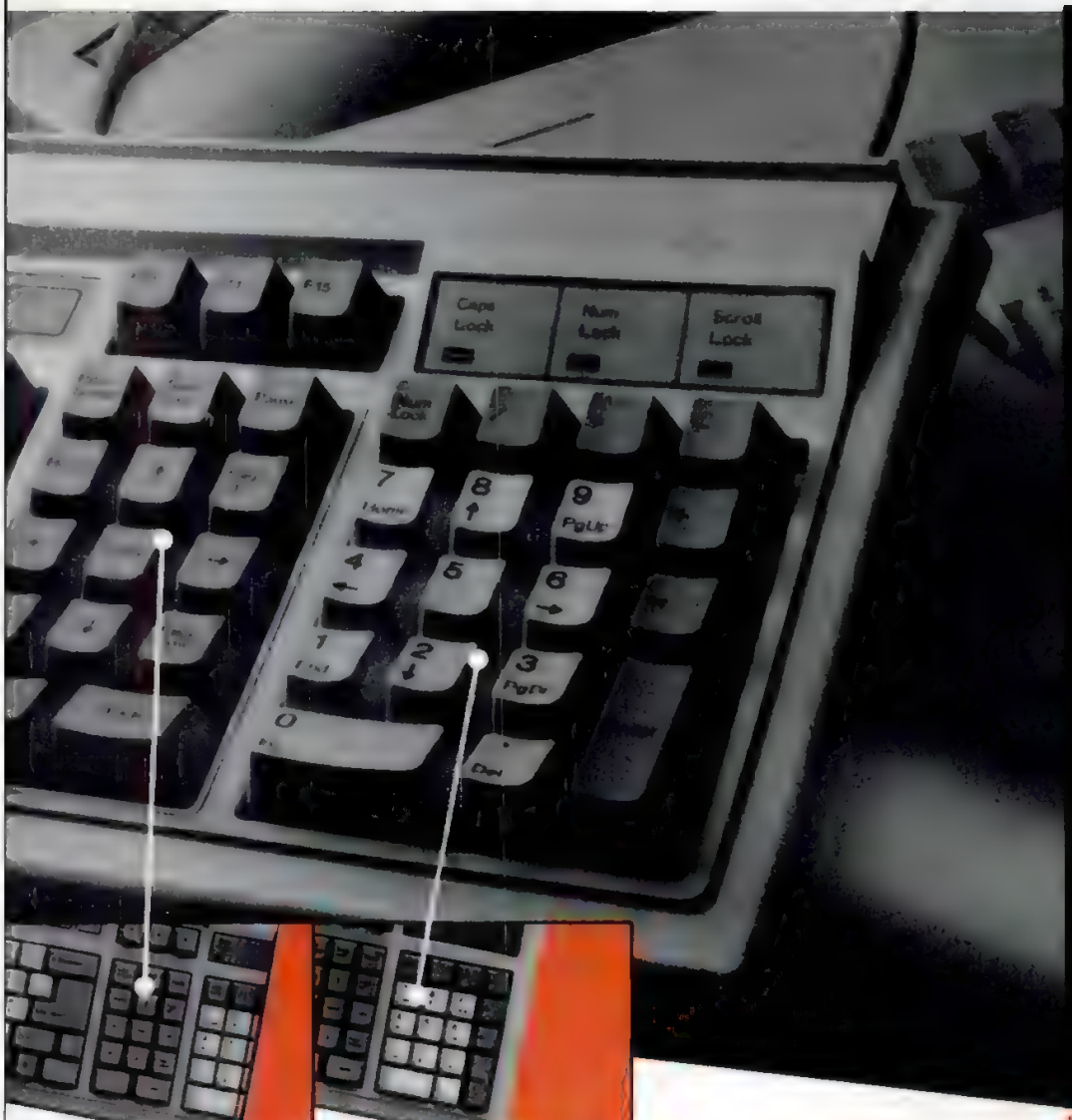

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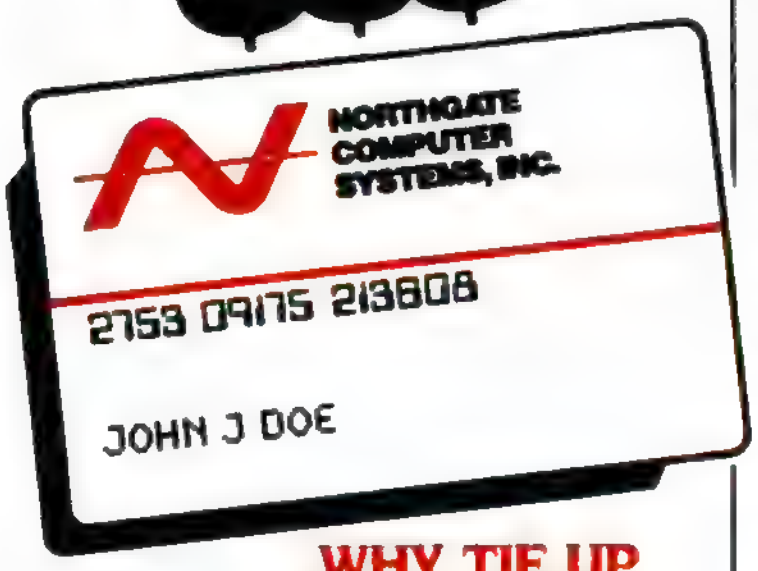

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- ☐ **JOINT CREDIT** with another person. Complete entire application.
- ☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- ☐ **INDIVIDUAL CREDIT.** Complete sections "a" and "b" only.

Please complete all appropriate sections, providing at least two year's residence and employment history. This will enable your application to be processed as quickly as possible. If you are self-employed, please be sure to complete section "D" on back.

a. Your Personal Information

Requested Line of Credit $_____

Your Name: First / Initial / Last — Date of Birth: Mo. Day Yr. — Social Security Number:

Present Address: Street / Apt. # / City / State / Zip — Home Phone: ( ) –

Date of Residence: Month / Year — Monthly Payment: $ — ☐ Buy ☐ Rent ☐ Other

Previous Address: — Dates of Residence: From To

Your Employer: (If self-employed, see rear panel.) — Date of Employment: Mo. Yr. — Position: — Monthly Income: Gross $ Net $

Employer's Address: Street / City / State — Business Phone: ( ) –

Previous Employer: / Address: — Dates of Employment: From To

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation

Other Income: ___

I have received since (Date)

Monthly Income: Gross $ Net $

Name and Address of Nearest Relative Not Living With You — Relationship

b. Credit Information

Include joint applicant's information, if joint account requested.

	Bank Name / Address		Payment	Balance
Bank Account:		☐ Checking ☐ Savings		
Bank Account:		☐ Checking ☐ Savings		
Bank Loan Reference:				
Bank Card Reference:	☐ VISA ☐ Mastercard			
Other Credit Card Reference				
Other Credit References:	Account No.	Expires:		

Driver's License No. — State — Expires:

c. Joint Applicant's Personal Information

*If you are a married Wisconsin applicant, you must provide your spouse's information below, even though your spouse may not be signing this contract.

Joint Applicant's Name: First / Initial / Last — Date of Birth: Mo. Day Yr. — Social Security Number:

Address: Street / Apt # / City / State / Zip — Date of Residence: Mo. Yr. — Home Phone: ( ) –

Employer: — Date of Employment: Mo. Yr. — Position: — Monthly Income: Gross $ Net $

Employer's Address: Street / City / State — Business Phone: ( ) –

d. Self-Employed Information

Complete this section only if you are self employed

Business Name — ☐ Proprietorship ☐ Corporation ☐ Partnership

Business Address — Business Telephone: ( ) –

Description of Business — Your Position — In Business Since

Your annual income from business — Business' annual income (gross) (net)

You must provide at least one of the following:

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Light in power and in pounds, 8088 laptops are still strong enough for most on-the-road computing needs. These battery-operated PCs are inexpensive and—thanks to recent technological advances—getting lighter.

by Alfred Poor

LIGHTWEIGHT LAPTOPS

Only in the portable arena are 8086- and 8088-based PCs still considered worthy of contemplation by serious computer users. Certainly, the 286 machines with VGA displays and the screaming 386 transportables garner far more attention. Nonetheless, 8088/86s weigh far less than their faster counterparts, on the average, and have low prices to match.

A battery-operated 286 portable with a 40MB hard disk can list for $6,000 or more, costing an average of $3,500 on the street; an AC-powered 386 model with the same

ILLUSTRATION: MARK WATTS PHOTOGRAPH: THOM O'CONNOR

size hard disk can set you back at least $8,000; $5,000 if you get it on the street. Compared with these prices, 8088/8086-based laptops are a bargain: the 15 laptops reviewed in this issue have list prices ranging from $995 to $3,600; their street prices run from $600 to $2,000.

We've reviewed every battery-operated 8088/86-based machine currently on the market. This is our first dedicated look at 8088-based portables since 1985. Some of these portables, notably Zenith Data Systems' recently introduced MinisPort, are brand new; others, like GRiD Systems Corp.'s GRiDLite XL, are revised versions of prior models; many, like Epson America's Equity, are just plain old, though still popular. We did not review Tandy's 1400 LT since Tandy is discontinuing that model, though an enhanced version of it should be available this fall.

A look at the features table will tell you that the battery-powered MS-DOS machines we've reviewed are built around an assortment of microprocessors running at a variety of speeds. All of these processors contain supersets of the microcode found in Intel Corp.'s 8-bit 8088 CPU. The 8088 itself powers five of these machines at speeds ranging from 4.77 to 8 MHz. The NEC equivalent to the 8088, the V20, is found in four of these machines, running at either 8 or 9.54 MHz. The 8088's larger sibling, the 16-bit 8086, is the heart of the GRiDLite XL and the Toshiba T1200HB, running at 8 and 9.54 MHz, respectively. The brains of the two fastest machines in this lineup, the V30, is the NEC equivalent to the 8086 and runs as fast as 10 MHz.

In a forward-looking design move, Sharp Electronics Corp. has chosen to employ the speedy NEC V40 processor in its laptops. Functionally equivalent to the 8088 and V20, the V40 integrates several functions onto the processor, reducing the number of components required for it to function.

All of these chips are based on complementary metal oxide semiconductor (CMOS) technology. CMOS chips draw far less power than the traditional high-density metal oxide semiconductor (HMOS) chips used by Intel for its 8088/8086 processors. For example, Harris Corp. makes a CMOS 80C88 chip that requires only 10 percent as much power as the original Intel chip. CMOS technology does exact a price, however, quite literally. A single Intel 8088 costs about $6, while an equivalent Harris 80C88 costs about $13.

WEIGHT, SCREEN, BATTERY

Because of the limited processing power that the 8088/86 CPU has to offer, we've placed more emphasis on the weight, screen quality, storage options, size, and price of these machines than we have on their speed. Weighing between 4.4 and 14.5 pounds, most of these portables can be purchased with a wide variety of different components so that you can mix and match to create the configuration that's ideal for you.

Four-fifths of these portables come with supertwist LCD screens; the rest use electroluminescent, black-and-white film-reflective LCD, or gas plasma (some make these available as options). Eleven of the screens are backlit or offer backlighting as an option—a power-consuming feature that's almost necessary if you want to use the portables anywhere other than an office. All display their images in monochrome CGA resolution.

We are seeing two new classes of laptops emerge: notebook- and pocket-size machines. They rely on new technology to shed weight.

The bulk of the batteries found inside these machines are nickel cadmium. According to our worst-case scenario for battery rundown tests—which doesn't take into account the battery-saving options that many of these models offer (see benchmark tests)—these batteries let you compute away from AC power anywhere from an hour and 20 minutes to 4 hours and 26 minutes. Many models come with batteries that are removable, and some come with optional battery chargers; both options let you carry more than one fully charged battery with you.

Hard disks are heavy components and draw a great deal of power, but we consider a hard-disk storage option mandatory for many applications these days. Eleven of these 15 machines can be purchased with hard disks or nonvolatile-RAM hard disk equivalents, most of which have a 20MB capacity.

IN SEARCH OF DICK TRACY

Many of us grew up reading about the technological wonders that Diet Smith dreamed up and implemented for Dick Tracy and his crew. Did any of us doubt that we would see two-way wrist video in our lifetime? So it is only natural that we would take to the concept of a computer you can pick up and carry to wherever the work might be.

The dream was hard to fulfill at first. Adam Osborne's computer was about as portable as a sewing machine, and the first Compaq portable was no better. But both were instant hits in the early '80s. From the other end of the size/performance spectrum came the Tandy Model 100 and NEC 8200, which were limited in capability but far easier to carry.

The portable market has been a continuing evolution of those two original sets of machines, aiming toward the best of both. The breakthrough came in 1986 when the battery-operated Toshiba 1000 was introduced, ushering in the era of truly portable yet reasonably powerful computers. Some of the machines introduced concurrently—by NEC, Sanyo, Datavue—have evolved into high-powered AT and 386 machines (and have given up on batteries altogether). Others are content to add backlit screens, higher resolutions, and hard disks to what is essentially the original design.

Today we are beginning to see two new classes of laptops emerge: notebook and pocket-size machines. They rely on new technology (and a few compromises) to shed significant portions of their weight; where 12 pounds used to be attractively svelte, it now is seriously overweight when compared with 4- to 7-pound notebook-size machines. Joining the latest 6.3-pound version of the Toshiba T1000, these new machines include the 4.4-pound NEC UltraLite and the 6.2-pound Zenith MinisPort. Three machines still in development at the time these reviews were written should also fall into the lightweight, high-tech category: a new machine from Agilis, the Atari Portfolio, and the Poqet PC.

Both the Atari Portfolio and the Poquet PC are expected to weigh 1 pound. The Poqet PC should easily fit into a man's suit pocket, measuring 8.75 by 4 by 1 inches. Besides a full QWERTY keyboard with smaller-size keys, the Poqet PC should

STORAGE MEDIA FOR LAPTOPS

by Bruce Brown

Led by the NEC UltraLite and Zenith MinisPort, a wave of smaller, lighter-weight laptops that store data in new and innovative ways is arriving on the market. As we move away from 3.5-inch floppy and hard disks, eventually some of these new options—2-inch floppy disk drives, ROM and RAM cards, and hard RAM—may completely change the way you store your programs and data using a portable.

The ideal storage device for a portable computer is reliable, small, and light. It should have high capacity as well as fast access and throughput times, but without consuming much power. Of course, standard data formats are always appreciated and, while we're at it, we want the storage to be inexpensive, too.

Arguably the least innovative of these new storage devices—at least in the way it affects the user—Prairie Technology's Model 220 hard disk is quickly becoming popular with laptop makers. With a 2.5-inch form factor, this 9-ounce, 20MB hard disk is small, lightweight, and requires roughly half the battery power of 3.5-inch hard disks. Found inside the new GRiDLite XL, this drive, with similar models from Connor and JVC, answers multiple needs because it's small, light, and combines good capacity with low power demands.

Zenith's 2-inch floppy disk drives enjoy the same advantage of familiarity. Looking like 3.5-inch floppies that shrunk in the laundry, these 720K disks share the same data format as the 720K 3.5-inch disks. The floppy disk drive itself takes up far less space, weighs half the weight (7 versus 14 ounces), and consumes 150 percent less power. The switch from 5.25-inch to 3.5-inch disks was traumatic for many users a few years ago, but now with the acceptance and proliferation of data-transfer programs such as *Lap-Link* and *The Brooklyn Bridge*, new formats don't carry the same burden. Still, if Zenith Data Systems is the only vendor to use them, the 2-inch floppies will be a source of aggravation. Zenith said the 2-inch floppy disk drive will catch on because it is readily adaptable to current controller cards.

NEC Home Electronics promises credit card-size ROM card versions of popular software for its UltraLite computer. Announced in August 1988, these cards began shipping in July 1989. Users who already own software will have to buy second copies of their favorite programs. NEC hopes to encourage bundling applications on both ROM cards and traditional floppy disks, but a spokesman at NEC said that any software upgrades or discounts to licensed software users will be determined by the individual software manufacturers.

ROM card storage is lightweight and permanent but will prove initially expensive because currently there is no industry-accepted standard. NEC also offers RAM cards that have a capacity of 256K, are nonvolatile, and run on a removable 1-year battery. RAM cards share the same basic characteristics as ROM cards, except that they are a reusable read/write medium, similar in function to a floppy disk.

Hard RAM is available in chips that need only intermittent power (similar to battery-run watches) and offer near instantaneous retrieval times. Cost and a 1-week storage time away from AC power are the drawbacks here, but the convenience, fast retrieval times, and economy of size make hard RAM an interesting storage alternative. The UltraLite uses hard RAM in its "silicon hard disks." The UltraLite starts with a 1MB silicon disk that can be expanded to 2MB, but the pluses and minuses of this storage scheme haven't changed since the time of Tandy/Radio Shack's popular Model 100.

The rapid growth in the laptop market is directly related to laptops' increased functionality. We'll see more laptop technology improvements because the promise of big profits will be a driving force behind technology advances. Who knows, we might even see cooperation among laptop vendors to establish new storage standards for the good of all; users would certainly benefit from the resulting lower prices. Right now the only vendor with the clout to establish such standards is IBM, but unfortunately it has its knees covering its ears and its elbows over its eyes as far as the laptop market is concerned. ■

have an 80-column by 25-row LCD screen and use removable-storage ROM and RAM cards—with DOS on a RAM card for fast loading—all for less than $2,000.

Atari's Portfolio promises to be a DOS-compatible machine of similar dimension as the Poqet. It should come with six built-in applications, including a simple word processor and a *Lotus 1-2-3*–compatible spreadsheet. Using RAM cards for storage, it should run on three AA batteries for a list price of $399.

Not just a laptop, the portable presently being readied for market by Agilis Corp. of Mountain View, California is a sealed and rugged hand-held workstation that offers a wide range of computing options. Featuring snap-together slices so that you carry only the components you need, the Agilis laptop is designed for vertical applications that occur outside the office and require specific computing needs. Options are expected to include an 80C88 as well as an 80386 processor; a display complete with touch screen; keyboard; and cellular radio communications to allow for wireless Ethernet capabilities. Prices should range from $2,000 to $20,000 depending on the configuration.

THE FUTURE IN YOUR LAP

Recent advances in miniaturization, VLSI, and application-specific integrated circuits (ASICs) have a double payoff for laptops. Besides letting you fit more components into a smaller space, these tiny chips typically draw less power than their larger predecessors. As a result, machines are getting smaller and their power requirements are less.

New designs in system architecture can also cut power draw and extend battery life. Laptop makers already let you turn off backlights, modems, and hard disk motors if they are idle for more than a certain

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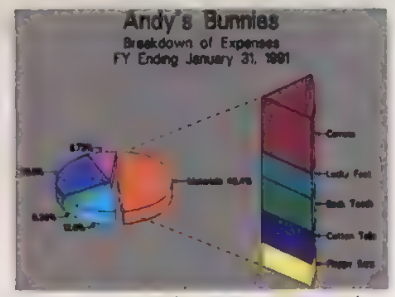

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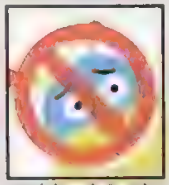

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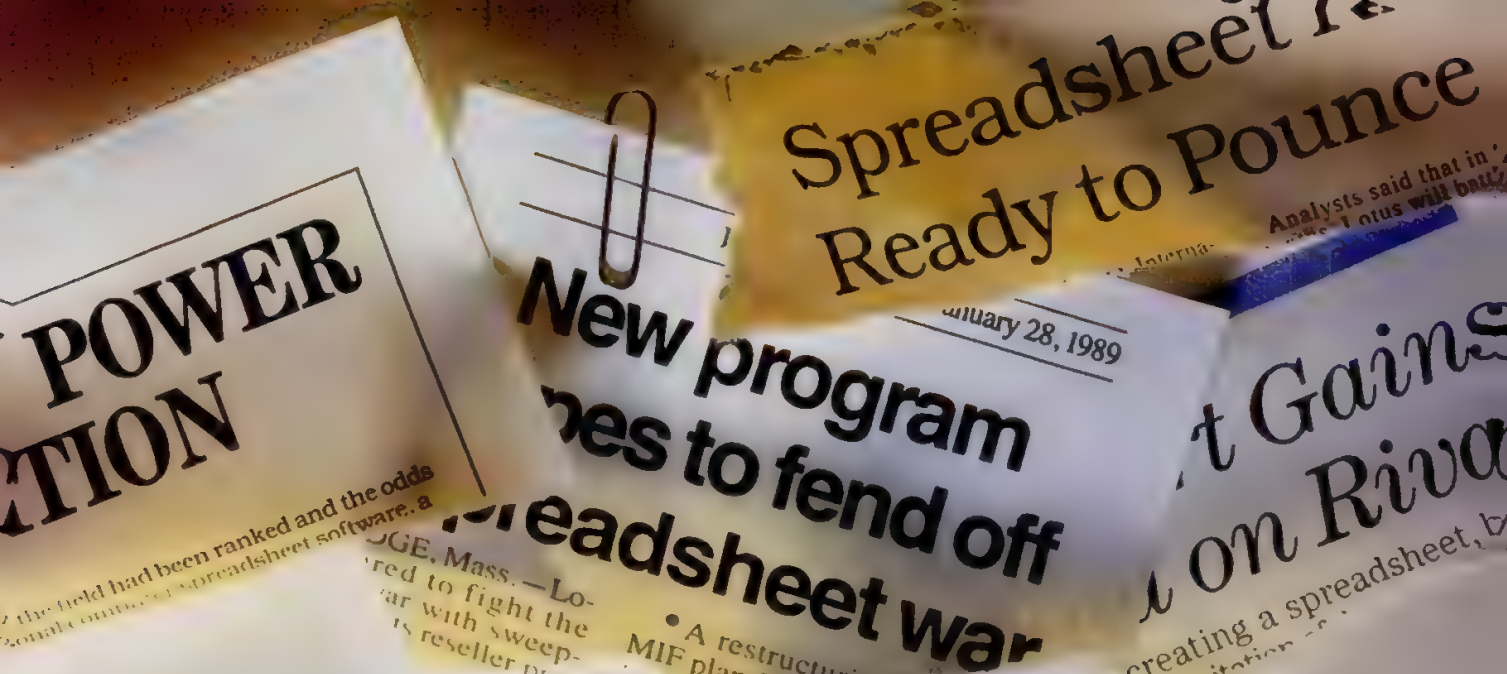

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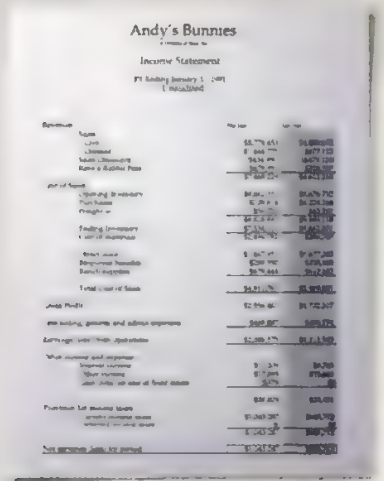
to be precise. Linking either in memory or on disk, either pages of the same spreadsheet or independent, either SuperCalc5's files or Lotus® 1-2-3®'s.



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CIRCLE 102 ON READER SERVICE CARD

length of time. You can expect to see CPUs that run at different clock speeds depending on their activity, thus "going to sleep" when they are not needed. New memory-mapping techniques such as those developed for the Poqet computer will allow programs to run directly from ROM cards without first having to be copied into system RAM. Such machines will be able to get by with less RAM and therefore draw less power.

One area that we are not limited by will be the screens. You might think that there is a minimum screen size that is legible; many people might say that some of the screens on the market are too small already. Before you write off the future, consider the Private Eye, a product under development by Reflection Technology in Cambridge, Massachusetts. This little item will sit in front of one eye (you wear it on a headband) and display an image of the screen that appears to "float" in space before you. Not only is it tiny, but there's also no way that *anyone* will be able to snoop over your shoulder with this one. The company intends to market it directly to laptop manufacturers.

Many of these machines can handle a fairly long plane trip without recharging.

At present, the most unavoidable limitation in laptop miniaturization is the necessity of including a keyboard. The classic IBM PC-XT keyboards were designed with keys on .75-inch centers; this translates to 7.5 inches to create the top row of letter keys (Q to P). Most users will likely agree that keys smaller than this feel cramped and awkward. Ultimately, this limits the minimum width for a conventional laptop keyboard to about 12 inches. Eventually we may invent an optional form of input; the touch screen used on the Agilis currently in development is one possibility.

It's obvious that portables will continue to shrink. But even with many of these machines tipping the scales at more than 10 pounds, it's clear that people are willing to pay the price and carry the weight, since battery-operated laptop sales continue to grow at a record pace.

Few people probably buy one of these 8088-based portables to serve as their only machine unless all they do is travel. For the same money as most of the hard disk models, you can afford to get a full-blown 386SX desktop machine that will blow any of these laptops off the field. Even if you travel back and forth between two places, two AT clones aren't much more expensive than some of these portables.

If you have a desktop computer somewhere and do a serious amount of travel, then one of these laptops may be well-suited for your needs. You can run your favorite MS-DOS applications wherever you go, albeit not as fast as on your desktop machine. Many of these machines can handle a long trip without recharging, provided that your plane doesn't spend too long waiting at the gate.

Chances are good that you don't need too much horsepower while on the road. People typically use laptops for word processing, electronic mail, simple spreadsheets, and desktop presentations. For such light DOS applications, integrated programs such as *Microsoft Works* or Software Publishing's *First Choice* are handy and compact all-purpose programs for laptops.

Depending on the sophistication required, all of these tasks can be accomplished by the lowly 8088. The 8088-based laptops currently sell for roughly $1,000 to $1,500 less than 80286 laptops, so until 286 prices fall in the next year or so, there will be a market for these entry-level machines.

So if you're looking for a way to rough-out reports at 35,000 feet, crunch bids in the field quickly, or check your e-mail from your hotel room as you wander from coast-to-coast, then read on. The future is just waiting for you to pick it up, and the good news is that it won't break your back or your wallet.

BONDWELL INDUSTRIAL CO. INC.

Bondwell B200

by Bruce Brown

A generic 8-bit laptop, the $1,295 Bondwell B200 has an extremely reasonable price and all the right parts for a low-end, lightweight laptop, with one glaring exception. Unlike any of its peers in this group review, the B200 does not support an internal modem.

Since a major reason for using a low-end laptop is to communicate with the main office from the road, the B200's failure to include an internal modem is a major drawback. The machine also lacks a hard disk option, but those flaws aside, it is an impressive machine for its class. Its 7.9-pound weight (with battery) makes it heavier than only the Toshiba T1000 and the NEC UltraLite. Its midrange 2-hour battery rundown test time—as measured by PC Labs—is respectable, though far from outstanding. Finally, it is the least expensive machine we tested (going by the price of the configuration tested, not the base price of these laptops).

FACT FILE

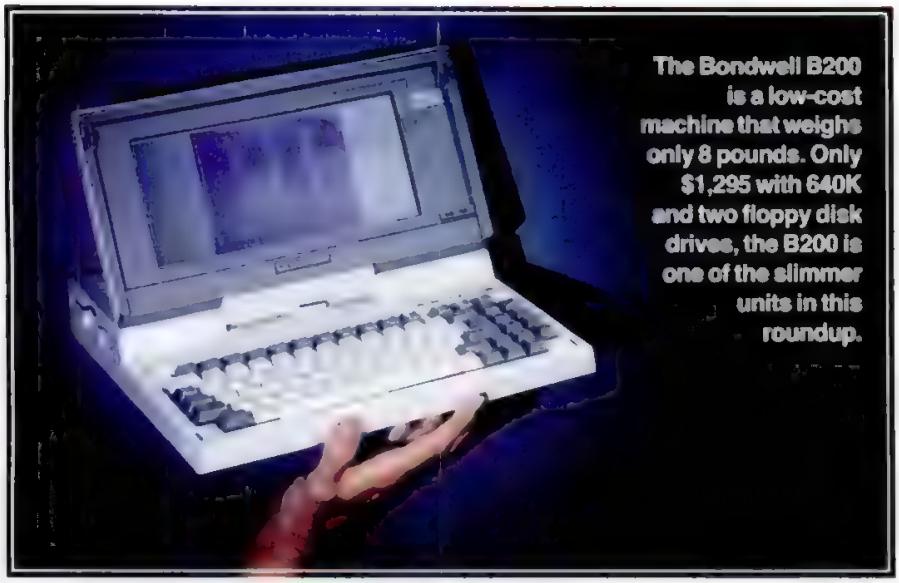
Bondwell B200
Bondwell Industrial Co. Inc., 47485 Seabridge Dr., Fremont, CA 94538; (415) 490-4300.
List Price: With 640K RAM, two 720K 3.5-inch floppy disk drives, DOS 3.3, $1,295.
In Short: The Bondwell B200 is a competent 8-pound laptop with a fair screen, good keyboard, and a reasonable price. The B200's 2.2-inch height makes it easy to fit inside a briefcase, but the lack of an internal modem is a major drawback.

CIRCLE 422 ON READER SERVICE CARD

The B200's list price buys you a 640K RAM machine with two 720K 3.5-inch floppy disk drives, MS-DOS 3.3, and GW-BASIC 3.22. There are no other drive or memory configurations available. The only options are a carrying case for $99.95 and extra batteries for $49.95 each. A 2-pound, 3.5-ounce AC adapter/battery charger is standard.

Those latter two options are important, since—though better than that of six of its peers—the B200's 7.2-volt battery's 2-hour, 2-minute life is still relatively short. (To conserve power, the portable does offer a user-selectable LCD shutoff mode that will turn off the power to the screen.) Fully recharging a battery takes a long 12 hours, but it's easy to pop batteries in and out of the bottom of the machine, so if you buy an extra battery you can get 4 hours of use without AC power. Of course since there's no provision for external recharging, it will then take you 24 hours to recharge both batteries.

A slim machine at only 2.2 by 13 by 12.2 inches (HWD), the Bondwell's white case has a foldaway handle under the front



The Bondwell B200 is a low-cost machine that weighs only 8 pounds. Only $1,295 with 640K and two floppy disk drives, the B200 is one of the slimmer units in this roundup.

PHOTOGRAPHY: THOM O'CONNOR

of the machine. The two floppy disk drives are located towards the rear of the computer, one on either side. The on/off switch is on the right, and all ports are in back. The B200 has a screen contrast control and a reverse video switch but no brightness control.

The B200's 80C88 processor runs only at 8 MHz; there is no provision for slowing it down to 4.77 MHz, as there is with many other laptops. Although the slower speed is usually ostensibly included for wider software compatibility, you shouldn't have any problems running standard applications software at 8 MHz these days.

The Bondwell's supertwist LCD screen is only fair. Since it is based on plain, not backlit, supertwist LCD, it is easy to read in good light, but in darker conditions the quality degrades quickly. Its viewable area measures 8.75 by 3.75 inches, and it tilts through a range of 180 degrees. Maximum resolution is CGA compatible 640 by 200 with the LCD or with an external monitor that attaches via a 9-pin RGB jack on the back of the computer.

Graced with a good feel and a slight mechanical click, the Bondwell machine's 81-key keyboard has dedicated separate keys for PgUp, PgDn, Home, and End, plus an inverted T cursor control key set. There's an embedded numeric keypad activated by the NumLock key, but no provision for an external numeric keypad or a larger keyboard. The only ports other than the RGB are a parallel printer port and a 25-pin serial port.

The Bondwell B200 is a slim unit that can easily fit inside a briefcase, but it comes up short as a competent light laptop. Its limited expandability and lack of an internal modem slot leave room for improvement.

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DATAVUE CORP.

Datavue Snap 1+1

by Bruce Brown

As its name implies, the Snap 1+1 is a two-piece laptop. The unique design snaps apart, letting you jettison the laptop's drives and RAM so that you can just take the keyboard and screen with you when you want to travel light. Unfortunately, in order to use the Snap 1+1 this way, you have to buy an extra memory card and battery, which pushes its price over the $3,000 limit.

The reasoning behind the modular design of the Snap 1+1 makes sense, since lugging around the entire 11.71-pound unit could conceivably be considered a trial. The back half of the machine contains the drives, normal RAM, and also has an industry-standard half-length expansion port. The front module includes the keyboard, screen, plus parallel, serial, and RGB external monitor ports. The front end weighs but 6 pounds with the extra ROM/RAM card. The problem is the price you must pay for necessary options. The RAM card costs $795 for a 512K version and $1,195 for a 1MB version, while the extra battery will cost you $99. (You could conceivably avoid buying a second battery by swiping the one that comes in the back of unit, then powering the back end with the 2-pound AC adapter).

We tested the base configuration of the Snap 1+1, which costs $2,295 and comes with 640K and two 720K drives, and a standard supertwist LCD. You can also choose the Snap 1+1 with optional electroluminescent backlit or gaslit screens. There are many other options as well, including a 20MB hard disk version that doesn't operate on battery power. The backlit LCD screen is the best compromise, in terms of price and readability. The keyboard is good, too, with reasonable keystroke action and feel. There are 84 keys in all, including a numeric keypad in the upper-right corner, separate from the cursor control keys.

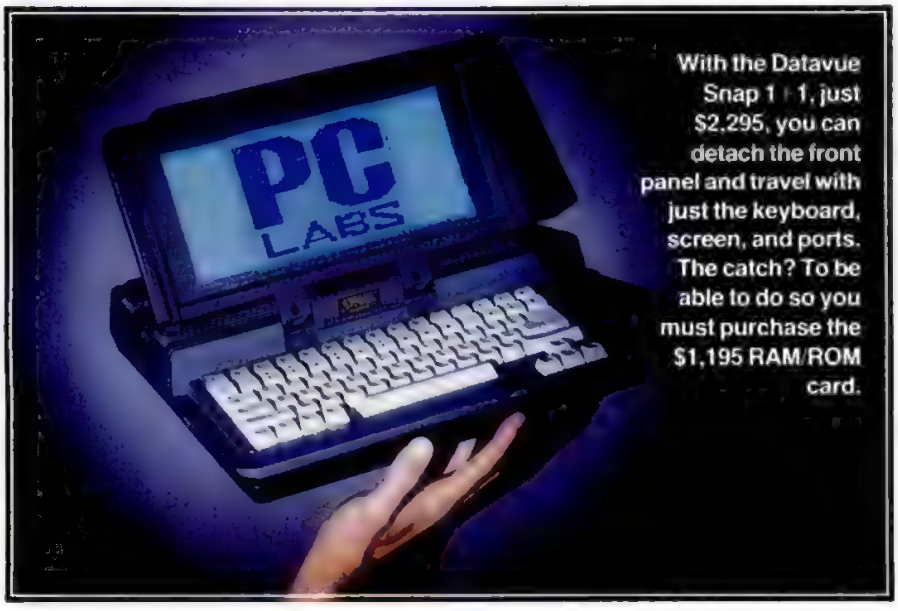
The Snap's CPU is a NEC V20 that runs at either 4.77 or 9.54 MHz. There are two removable nickel cadmium battery choices, a 1.3-aH (ampere-per-hour) version, which comes with the unit, or a 1.7-aH version for $99. Neither is standard. With the 1.3-aH battery, the Snap 1+1 ran for almost 3.5 hours on the PC Labs rundown test. Recharge time is 8 hours.

The Snap 1+1 is also available in AC-powered 20MB hard disk version for an additional $1,200. The Datavue Snap 1+1 is an interesting concept—a laptop with its own docking setup, but after adding in the price of the additional memory card and battery, it costs too much.

FACT FILE

Datavue Snap 1+1
Datavue Corp., One Mecca Way, Norcross, GA 30093; (404) 564-5555.
List Price: With 640K RAM, two 720K 3.5-inch floppy disk drives, DOS 2.11, $2,295. 512K ROM/RAM card, $795; 1MB ROM/RAM card, $1,195; 1.7-aH battery, $99.
In Short: The Datavue Snap 1+1 is an unusual two-part 11-pound laptop with a standard expansion base that holds the system RAM and drive(s). If you want to travel with just the 4.2-pound front half (essentially just the keyboard, screen, and ports), you must buy an expensive ROM/RAM card.

CIRCLE 423 ON READER SERVICE CARD



With the Datavue Snap 1+1, just $2,295, you can detach the front panel and travel with just the keyboard, screen, and ports. The catch? To be able to do so you must purchase the $1,195 RAM/ROM card.

DATAVUE CORP.

Datavue Spark

by Bruce Brown

The price leader among the hard-disk-equipped laptops reviewed in this roundup, the Datavue Spark features a fine keyboard and a good screen. Teamed with its respectable midrange weight and battery rundown test numbers, this laptop from Datavue offers an impressive package of goods.

The version of the Datavue Spark we tested lists for $2,195 with 640K RAM, an electroluminescent backlit LCD screen, a 720K 3.5-inch floppy disk drive, and a 20MB hard disk. Its NEC V20 processor chip can run at either 4.77 or 9.54 MHz, and it comes standard with MS-DOS 3.3 and a ROM-based system help program. The machine weighs 11.25 pounds with the hard disk and its 1.7-aH (ampere-per-hour) battery, which, oddly, is not standard, but a $99 option. The case is 2.5 by 13.2 by 13 inches (HWD), but it looks smaller, probably because of its attractive dark brownish-gray color.

The Spark's screen measures 9.4 by 4.25 inches, a good size. In the electroluminescent version we tested, it proved capable of producing very readable characters. Maximum resolution is 640 by 200 in CGA-compatible mode, and the standard 9-pin RGB port accepts an external CGA monitor.

The Spark's 77-key keyboard is good, though not as mechanically clicky as the Toshiba T1200 or Sanyo keyboards. With an easily accessed system control program, you can turn on an electronic click for the keyboard and set other system options. The keyboard has cursor control keys in an inverted T design at the bottom right of the keyboard; PgUp, PgDn, Home, and End are activated using the left-mounted Fn key, which also activates the embedded numeric keypad.

The back of the Spark sports a parallel port, serial port, RGB port, external floppy disk drive port (a 360K 5.5-inch floppy

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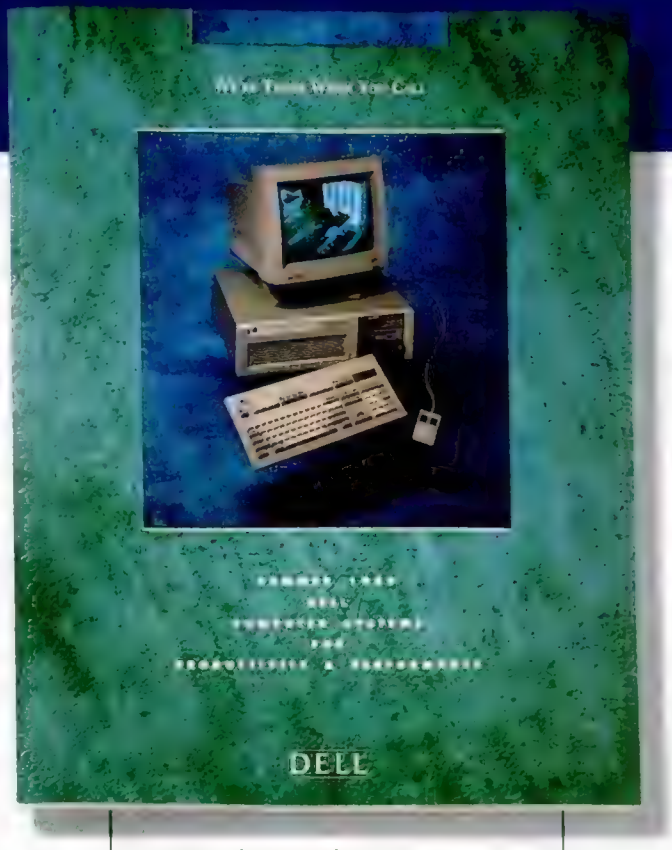

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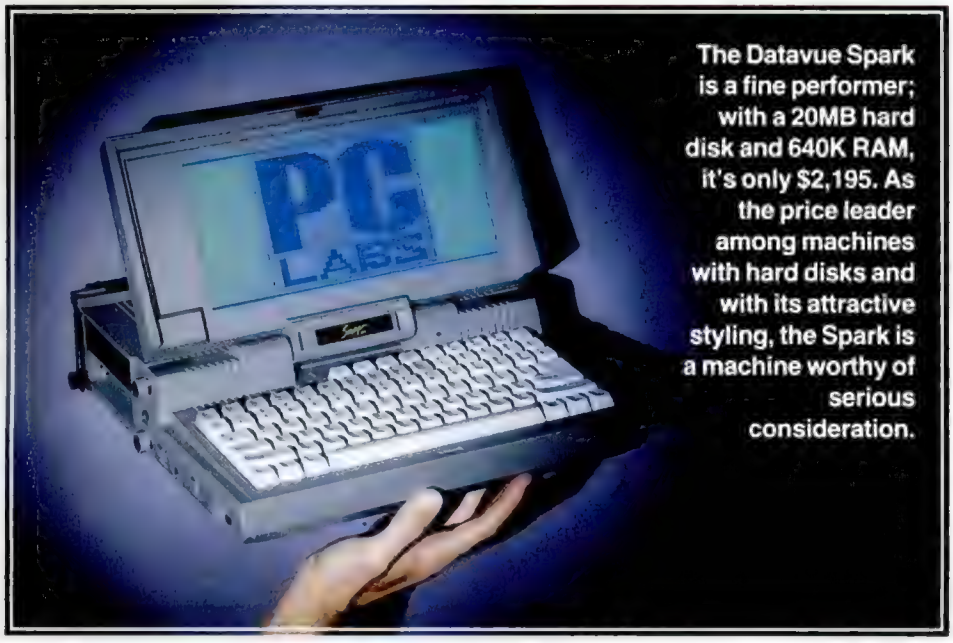

The Datavue Spark is a fine performer; with a 20MB hard disk and 640K RAM, it's only $2,195. As the price leader among machines with hard disks and with its attractive styling, the Spark is a machine worthy of serious consideration.

FACT FILE

Datavue Spark
Datavue Corp., One Mecca Way, Norcross, GA 30093; (404) 564-5555.
List Price: With 384K RAM, one 720K 3.5-inch floppy disk drive, DOS 2.11, $995; with 640K RAM, 20MB hard disk, electroluminescent backlit LCD screen, DOS 3.3, $2,195. 1.7-aH battery, $99.
In Short: The Datavue Spark is an exceptional deal in an 8-bit laptop. The hard disk drive version with the backlit screen and 640K RAM gives you a bright screen, good keyboard, and 20MB of storage at a great price.

CIRCLE 424 ON READER SERVICE CARD

disk drive option costs $495), and an external expansion bus. An optional 1,200-bit-per-second Hayes-compatible internal modem costs $325.

You can conserve battery power by setting the hard disk and screen backlighting to turn off at specified intervals. In the PC Labs rundown test with everything running, the battery lasted a respectable 2 hours and 41 minutes. Fully recharging the battery takes 8 hours.

You can buy the Spark in many configurations, starting with a base of 384K RAM and one floppy disk drive for only $995. However, the best deal, besides the configuration we tested, was the two-floppy, 640K, backlit version for $1,450. (If you opt for the dual-floppy version, you get MS-DOS 2.11 instead of the DOS 3.0 you get with hard disk versions.) As is the case with many machines, the Datavue Spark is often sold at a discount by dealers, so you might get it for even less.

Datavue is a relatively unknown portable purveyor, but the Spark is so versatile and such a good deal that it makes the company worth learning about. In fact, the Spark, in its many permutations, may be the perfect solution for 90 percent of the people looking for 8-bit laptops.

EPSON AMERICA INC.

Epson Equity LT

by Alfred Poor

Like an aging Hollywood star, the Epson Equity LT has seen itself progress from being all the rage to yesterday's news. The performance of the laptop's processor still puts it near the head of its class, but in the admittedly low-power 8086/8088 arena, processor speeds are no longer that important. In the areas that now count—price, weight, screen legibility, battery life—it averages, well, average.

The version of the Equity LT we tested comes with 640K RAM, a backlit screen, one 720K floppy disk drive and a 20MB hard disk; it costs $2,998. The NEC V30-based laptop with the 10-MHz clock speed also comes in a variety of other flavors and with a choice of LCD screens, the cheapest of which is the dual-floppy version without any screen for $1,699.

Originally introduced in September of 1987, the Equity LT has features that still sound impressive. Its screen is only CGA with a 640 by 200 resolution, but its technology is backlit, supertwist LCD. (You can get an LCD panel without a backlight for $150 less.) The unit also sports a full-featured 85-key keyboard, with function keys across the top and a separate numeric keypad to the right. The computer ships with MS-DOS 3.2 and GW-BASIC, plus diagnostics and setup programs on disk. It has ports on the back for an external monitor, a serial port, and a parallel port that can also be used to hook up to an external floppy disk drive.

As you zoom in for a closer look, however, you realize that some of the Equity's features are more liabilities than assets. Take the screen for example. The technology per se is up to date, but in its implementation you won't find it to seem so advanced. The screen comes up showing white letters on a blue background, the opposite of what most of its competition offers, and more difficult to read. If you look beneath a little hatch on the keyboard, you find a set of four switches, the first of which reverses the display. With blue letters on a white background, the display is a little easier to read, but the image is still marred by a spidery character set and vertical streaking.

The keyboard is quiet with a slight tactile feedback, but generally feels mushy. There are only ten function keys, with no provision for the F11 and F12 keys. The numeric keypad to the right is handy, but the arrangement adds to its length, making

FACT FILE

Epson Equity LT
Epson America Inc., 2780 Lomita Blvd., Torrance, CA 90505; (800) 922-8911.
List Price: With 640K RAM, dual 720K 3.5-inch floppy disk drives, $1,699; 20MB hard disk, DOS 3.2, GW-BASIC, $2,599. Reflective LCD, $249; backlit LCD, $399; backlight replacement panel, $99; internal 1,200-bps modem, $299; carrying case, $49; extra AC adapter, $129; cigarette lighter adapter, $29.
In Short: The Epson Equity LT has not aged gracefully and now appears to be overweight, with a host of quirks and limitations that reduce its appeal. Coupled with a price similar to that of the competition, it represents a less attractive value than do others that supply superior power per dollar.

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CIRCLE 732 ON READER SERVICE CARD

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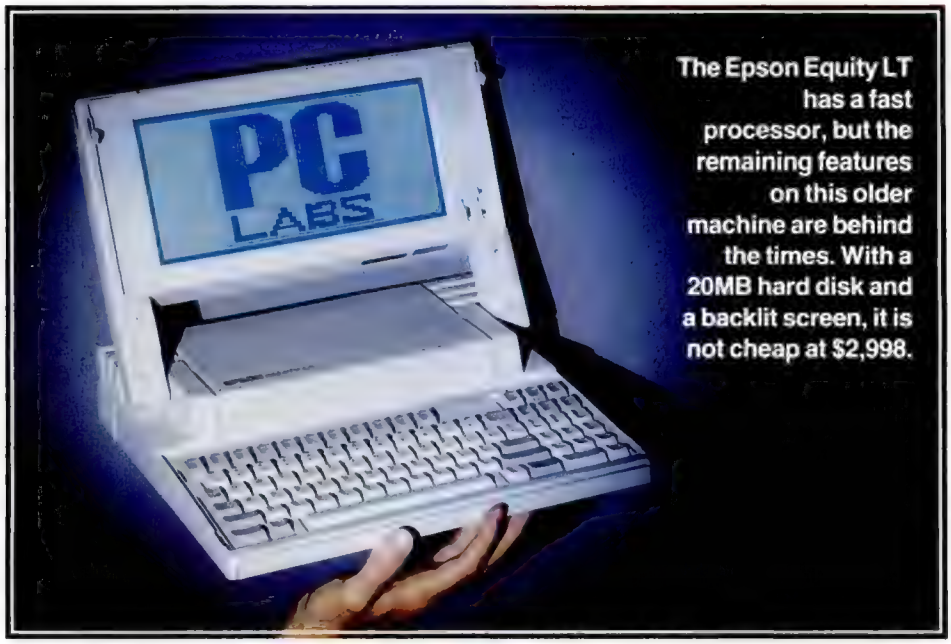


The Epson Equity LT has a fast processor, but the remaining features on this older machine are behind the times. With a 20MB hard disk and a backlit screen, it is not cheap at $2,998.

it about 1.5 inches wider than the other machines in its class.

The dimensions of the case are about the same as those of its competitors, measuring 3.1 by 13.6 by 12.2 inches (HWD). Still, the Equity LT tips the scales at a pound or two more than other machines of similar dimensions, 13.9 pounds overall with the battery. The extra weight could be acceptable if it translated to longer battery life, but in the PC Labs rundown tests, the Equity LT pooped out in less than an hour and a half. That's half the battery time of some of the other hard disk machines we reviewed.

Then there are all the irritating little details. There are two sets of DIP switches, in addition to CMOS configuration settings that must be set by a program on-disk. The metal carrying handle is too thin let you carry the unit for long stretches. The connectors on the back are unprotected, even though they are located in the area that you'd naturally want to set the unit down upon. The only expansion slots are in a proprietary format: one is used by the hard disk and the other by the internal modem card. Just one modem is offered, a 300/1,200-bit-per-second model, and no memory upgrade exists.

All of this could be overlooked if the Equity LT was offered at a more attractive price. Both the backlit dual-floppy and the hard disk versions carry prices comparable to other similarly configured machines. But even with a steep discount on a street price, neither model is a compelling bargain given the laptop's limitations.

GRID SYSTEMS CORP.

GRiD 140XT

by Bruce Brown

Even though its base price is higher, the $2,750 GRiD 140XT is a bargain compared with the GRiDLite XL. Featuring 768K RAM, DOS 3.31, a 720K 3.5-inch floppy disk drive and a 20MB hard disk, the laptop has a good backlit supertwist LCD screen and a responsive keyboard. Unfortunately, its heavy weight and short battery life offset its advantages.

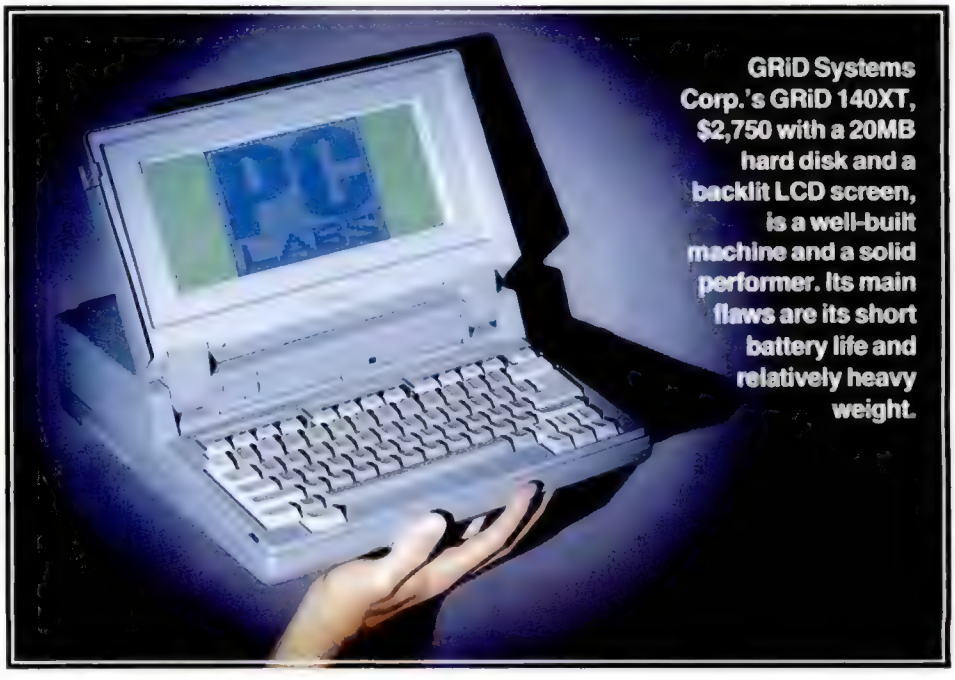
The 140XT is essentially the same machine as the discontinued Tandy 1400LT, the base unit of which is being enhanced and should soon be being reintroduced as Tandy's 1400HD (hard disk version) and 1400FD (floppy disk version). Like those of the 1400LT, the 140XT's disk drives are inconveniently placed directly above its keyboard—just below the hinge where the screen folds over the keyboard. Inserting and removing disks is awkward at this location, as your fingers always come precariously close to the keys.

Compared with its sibling GRiDLite XL, the 140XT just can't cut it in the battery and weight department. The battery lasts only about 2 hours (although you can buy an external recharger), and the machine's 13.3-pound mass (almost 15 pounds if you carry the AC power supply), combined with its narrow carrying handle, make lugging it a chore. Although it gives you more function for your money, its extra weight is too high a price to pay.

FACT FILE

GRID 140XT
GRiD Systems Corp., 47211 Lakeview Blvd., Fremont, CA 94537; (800) 222-GRID.
List Price: With 768K RAM, 20MB hard disk, 720K 3.5-inch floppy disk drive, DOS 3.31, $2,750. 2,400-bps modem, $300.
In Short: The GRiD 140XT, a twin of the discontinued Tandy 1400LT, has an exceptionally good backlit supertwist screen, a good keyboard, and a standard 20MB hard disk. The price is okay, but you may still be able to find the Tandy version for less money.

CIRCLE 426 ON READER SERVICE CARD



GRiD Systems Corp.'s GRiD 140XT, $2,750 with a 20MB hard disk and a backlit LCD screen, is a well-built machine and a solid performer. Its main flaws are its short battery life and relatively heavy weight.

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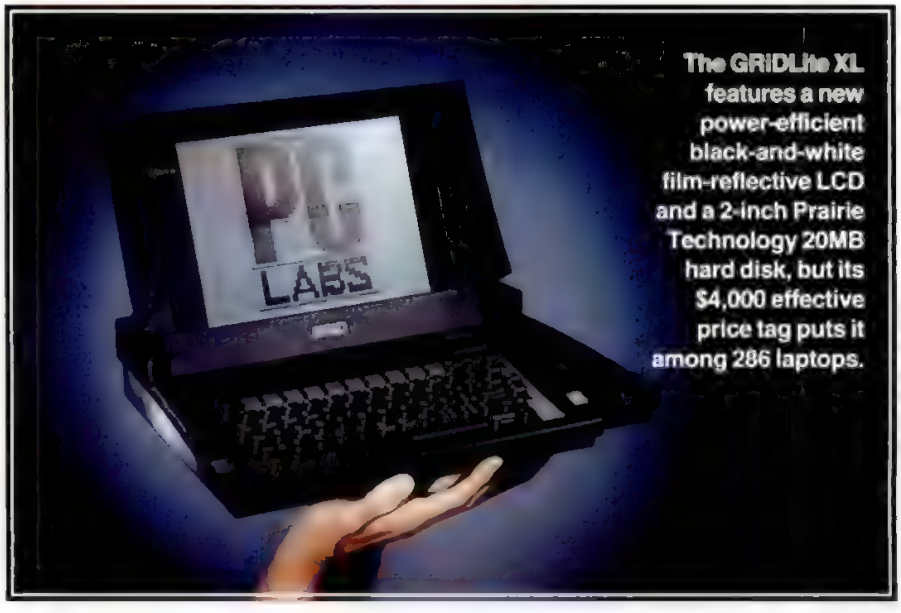
GRID SYSTEMS CORP.

GRiDLite XL

by Bruce Brown



The GRiDLite XL features a new power-efficient black-and-white film-reflective LCD and a 2-inch Prairie Technology 20MB hard disk, but its $4,000 effective price tag puts it among 286 laptops.

It should come as no surprise that the most expensive lightweight laptop we tested comes from GRiD Systems Corp.—a company that has always targeted the corporate market, where quality and vendor strength are higher concerns than price.

The classy-looking XL is actually an updated GRiDLite Plus, an 80C86 processor-based computer that can run at either 4.77 or 8 MHz. In the original scheme of things, before GRiD was purchased by Tandy Corp., the GRiDLite was the company's low-end machine, and its starting price is still the lowest of the line. The base price of the GRiDLite XL is a mere $1,950; however, that's without DOS 3.3 (a $150 option) and with only 128K RAM and one 1.4MB 3.5-inch floppy disk drive. The price climbs quickly when you look at a configuration that would actually allow you to do work. Our test unit, which had 640K RAM, a 20MB hard disk instead of the internal floppy disk drive, an external 1.4MB floppy disk drive, a 2,400-bit-per-second modem, and a carrying case, lists for $4,430—a hefty price for an 8-bit laptop.

A true GRiD, the GRiDLite XL's ample option list includes memory upgrades, modems, internal and external disks, operating system and applications software on ROM chips, cables, adapters, batteries, external battery charger, printer, and carrying case. You can also select among optional extended warranty and annual maintenance programs.

Upgrading the standard 128K RAM to 640K is a $300 option. You can also buy 512K and 1MB EMS RAM options for $395 and $495, respectively, to increase total RAM to 2.1MB. The included EMS drivers are LIM 4.0 compatible. The GRiDLite XL has slots for up to eight ROM chips, which can mean up to 1MB of ROM. GRiD sells some software on ROM but will also program ROM chips with your applications for $200 per program, plus the price of the ROM chips ($50 for 64K chips and $100 for 128K chips).

The attractive GRiDLite XL case is black with a slanted front, achieving a streamlined look on a machine that isn't light. Weighing in at 9.9 pounds with the standard nickel cadmium battery, the XL measures 3 by 13.25 by 11.25 inches (HWD). The standard AC power supply/battery charger weighs an additional pound and a half.

The GRiDLite XL has room for only one drive. If you have the basic floppy disk drive system you can have MS-DOS on a ROM chip for $50, leaving the floppy disk drive for application software and storage. Or you can opt for the $1,195 20MB hard disk. Two external floppy disk drives are available: a $350 1.44MB 3.5-inch unit, and a $395 360K 5.25-inch drive. The 20MB hard disk sold for the GRiDLite XL is a Prairie Technology Model 220. This 9-ounce, 2.5-inch format drive draws less power than the older GridLite Plus hard disk.

The XL's liquid crystal display is also new. The GridLite Plus used a backlit LCD; the XL has a newer technology that GRiD calls *black-and-white film-reflective LCD*. While the newer screen consumes less power than backlighting, it's not as bright, so the improvement comes at a heavy cost. Maximum resolution is CGA compatible 640 by 200, and there's a 9-pin RGB port for an external CGA monitor.

The new hard disk and screen do help battery performance significantly. The GRiDLite XL's removable, rechargeable nickel cadmium battery is rated at 3 to 4 hours at 4.77 MHz, with a recharge time of 10 to 12 hours. The numbers are realistic—in the PC Labs battery rundown test with the hard disk version at 8 MHz, the battery lasted just shy of 4 hours. An extra battery costs $70.

Because of its short keystroke length and soft touch, the XL's 71-key keyboard is only fair. It has a function key on the right to activate the PgUp, PgDn, End, and Home keys, which are also on the right. A Code key on the left side activates the embedded numeric keypad.

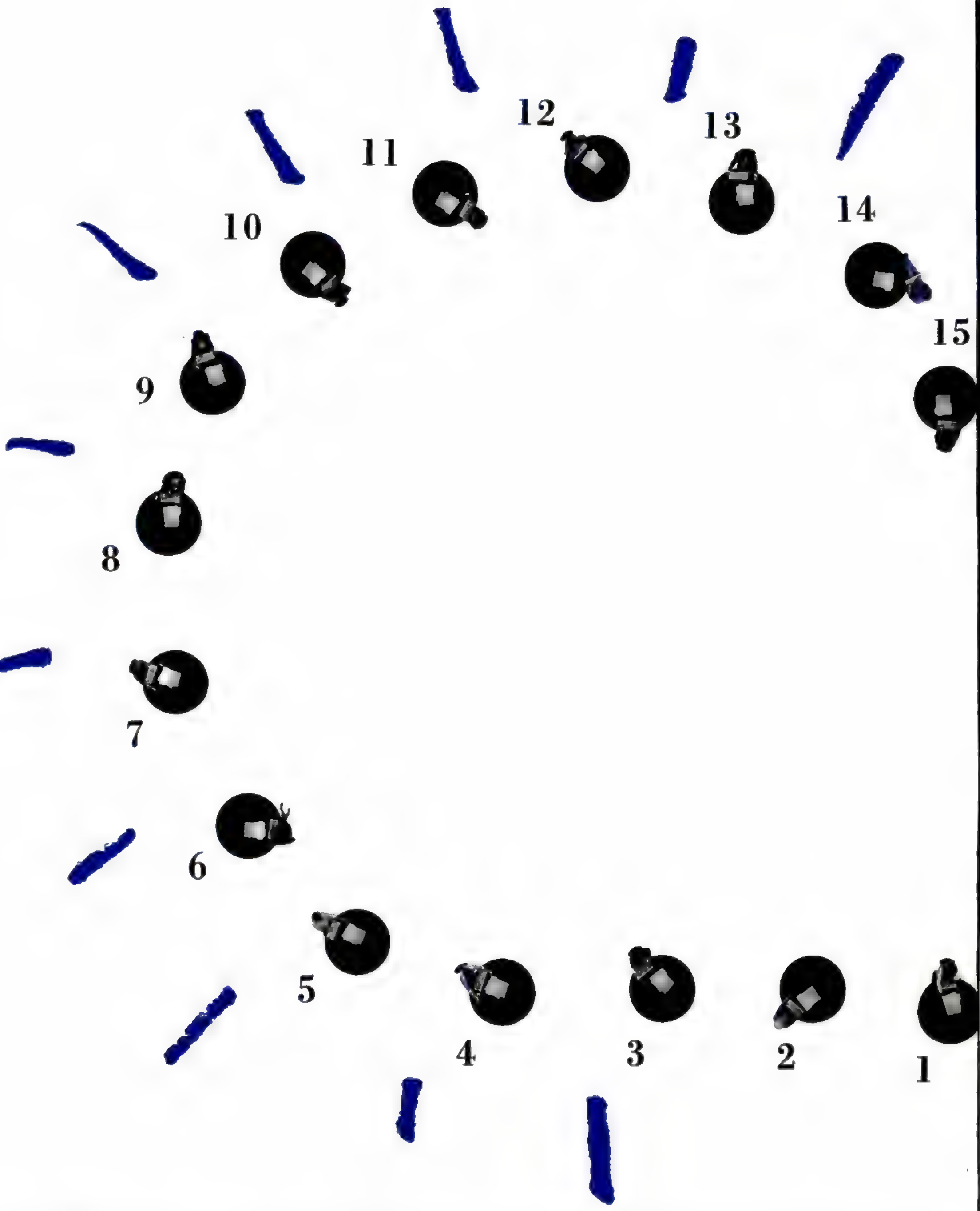
You can expand the GRiDLite XL with an 8087 math coprocessor ($195) and an internal Hayes-compatible 2,400-bps modem for $595 or an error-correcting 2,400-bps modem for $695. Parallel and serial ports are standard.

In sum, the GRiDLite XL offers some attractive features, including good battery life and an impressive option list, but it is dragged down by its keyboard and screen. Though you can use its many options to make it almost whatever you want, you can easily spend what might buy another vendor's 286 laptop.

FACT FILE

GRiDLite XL
GRiD Systems Corp., 47211 Lakeview Blvd., Fremont, CA 94537; (800) 222-GRID
List Price: With 128K RAM, one 1.44MB 3.5-inch floppy disk drive, DOS 3.3, $2,100; with 640K RAM, 20MB hard disk, 1.4MB 3.5-inch external (instead of internal) floppy disk drive, 2,400-bps modem, carrying case, $4,430.
In Short: The GRiDLite XL is an update of the GRiDLite Plus. This attractive machine includes a new-technology, black-and-white, film-reflective LCD that saves on battery life but isn't as effective as backlighting. The screen and keyboard are only fair, and the price can easily get too high for an 8-bit laptop.

CIRCLE 427 ON READER SERVICE CARD



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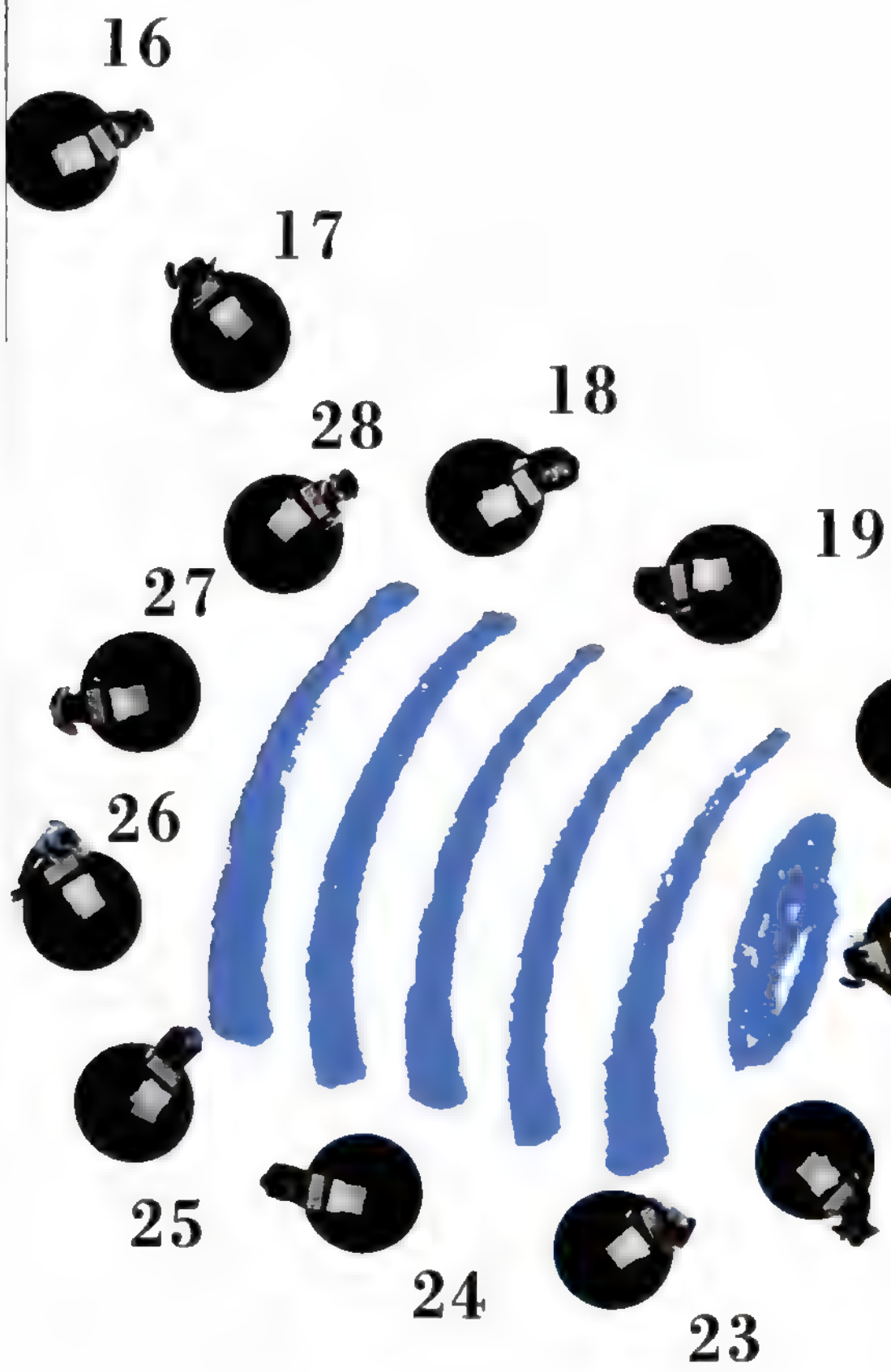

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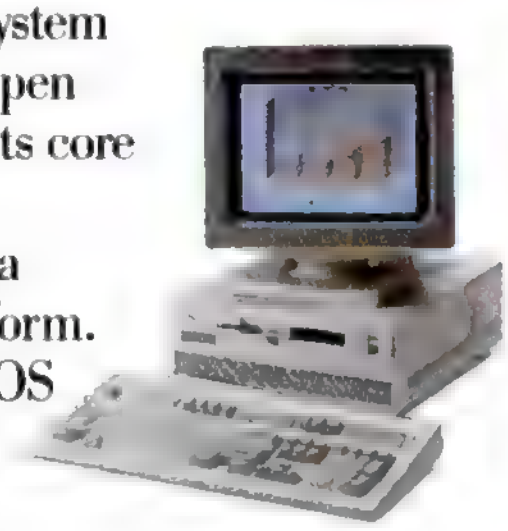

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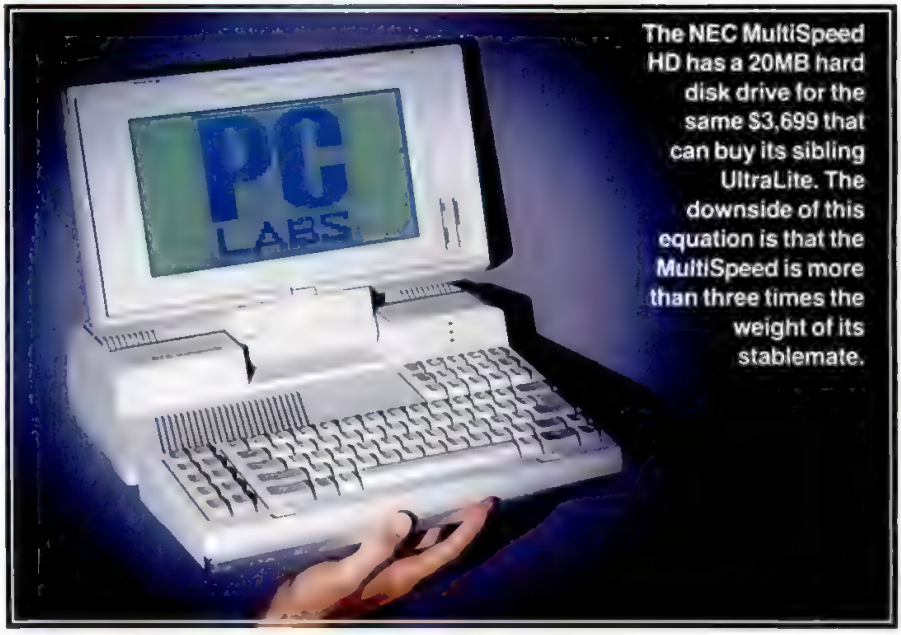
NEC HOME ELECTRONICS (U.S.A.) INC.

NEC MultiSpeed HD

by Matt Ross



The NEC MultiSpeed HD has a 20MB hard disk drive for the same $3,699 that can buy its sibling UltraLite. The downside of this equation is that the MultiSpeed is more than three times the weight of its stablemate.

Perhaps the biggest problem that's facing the MultiSpeed HD, apart from its $3,699 price tag, is the comparisons that it gets with its smaller sibling, the NEC UltraLite. At 14.5 pounds, the MultiSpeed HD seems huge; it is the heaviest machine in this roundup.

The MultiSpeed HD comes equipped with a 20MB hard disk along with 640K RAM, plus utilities, including conveniences such as telecommunications, a notepad, outliner, and on-screen help. The removable backlit CGA screen that came with our unit is a generous 9 by 4.75 inches, with slide contrast and brightness controls at the bottom right of the screen.

The 85-key keyboard is excellent. The function keys are on the left, a separate numeric cursor pad is on the upper-right side. Help and pop-up keys activate utilities, and all keys are full size with excellent tactile feedback.

The battery life, according to our PC Labs tests, is a respectable 1 hour and 45 minutes for a hard disk machine. The MultiSpeed offers power-saving, user-selectable time-outs for screen backlighting and hard disk shutoff options, but these features were disabled when we performed our rundown test. The nickel cadmium battery is removable but, unfortunately, must be installed to recharge, which takes 8 hours.

Ports include a standard 25-pin serial, external drive, parallel, DB-9 RGB video, and also a reset button.

There's no question that the MultiSpeed HD is a good performer, but the simple fact is that time is catching up to it. The other hard disk machines that we looked at in this roundup offer similar features less hundreds of dollars and 2 or 3 pounds. With the technology NEC has demonstrated in its UltraLite and ProSpeed laptops, it is becoming increasingly obvious that the MultiSpeed is simply from a previous generation.

FACT FILE

NEC MultiSpeed HD
NEC Home Electronics (U.S.A.) Inc., 1255 Michael Dr., Wood Dale, IL 60191-1094; (312) 860-9500, (312) 860-0335 (tech support).
List Price: With 640K RAM, 20MB hard disk, 720K 3.5-inch floppy disk drive, *PopUp* software utilities, DOS 3.21, $3,699. Internal 1,200-bps modem, $399; 2,400-bps modem, $499; carrying case, $129.
In Short: A heavyweight in comparison with its high-tech sibling, the MultiSpeed tipped the scales at 14.5 pounds. With a 20MB hard disk, backlit screen, and full-function keyboard, the MultiSpeed HD remains a solid performer.

CIRCLE 428 ON READER SERVICE CARD

NEC HOME ELECTRONICS (U.S.A.) INC.

NEC UltraLite

by Matt Ross

NEC's UltraLite unit is so different from most of the other machines in this roundup that it really should be considered in a completely different class. That class comprises ultraportable, fully DOS functional, notebook PCs; the UltraLite was the first representative. This trendsetter is expensive—especially for a machine based around an 8086-equivalent NEC V30—but no other laptop, with the possible exception of Zenith's new MinisPort, can match its computing and communications power in such a small size.

Weighing in at 4.4 pounds and measuring only 11.75 by 8.25 by 1.25 inches (HWD), the UltraLite is the smallest and lightest machine in this roundup by far. It fits easily into any briefcase, along with its 1.2-pound AC adapter, making it a complete travel machine at about 5.5 pounds. With 640K RAM standard, the UltraLite comes in two configurations: a 1MB silicon hard disk version for $2,999 or 2MB for $3,699. Both come complete with a 2,400-bit-per-second internal modem, plus DOS 3.3, *Microsoft DOS Manager 2.0*, and *Lap-Link 2.1* built into ROM. Because this is not the self-installing version of *Lap-Link*, NEC also provides the soft-

FACT FILE

NEC UltraLite
NEC Home Electronics (U.S.A.) Inc., 1255 Michael Dr., Wood Dale, IL 60191-1094; (312) 860-9500, (312) 860-0335 (tech support).
List Price: With 640K RAM, 1MB silicon hard disk, internal 2,400-bps modem, *Lap-Link* 2.0, *Microsoft DOS Manager* 2.0, DOS 3.3, $2,999; with 2MB silicon hard disk, $3,699. 256K RAM storage cards, $299 each; 1.44MB 3.5-inch external floppy disk drive, $399; carrying case, $129.
In Short: The state of the art in laptop technology, the UltraLite has a bright screen, full-size keyboard, and 2,400-bps modem and weighs only 4.4 pounds. A September 1989 revision of the unit promises removable batteries and an external charger, answering the current battery limitations. Wait for that one. Otherwise, the UltraLite is the most portable fully-DOS-compatible PC available.

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CIRCLE 223 ON READER SERVICE CARD

ware on both 3.5-inch and 5.25-inch floppy diskettes.

The new class of machine that the UltraLite began heralds several remarkable technological advances. The first is an extremely thin backlit electroluminescent LCD that is bright and legible. When opened, it reveals a full-size 78-key keyboard. Emulating a hard disk is NEC's dynamic RAM silicon disk, while for removable storage you have a proprietary 60-pin read/write slot that accepts ROM or RAM cards the size of credit cards.

The machine puts some impressive performance times up on the board. The NEC V30 processor operates at either a speedy 9.83 MHz or 4.92 MHz; it performed fastest of all the laptops reviewed here on the PC Labs instruction mix benchmark test. When combined with the rapid access times of the silicon hard disk, its overall system speed is also fastest.

8088/86-BASED LAPTOP COMPUTERS: SUMMARY OF FEATURES

(Products listed in ascending price order)

AT A GLANCE	Datavue Spark	Toshiba T1000	Bondwell B200	Sanyo MBC-16LT2	Epson Equity LT	Zenith MinisPort	Toshiba T1200
Base price	$995	$999	$1,295	$1,399	$1,699	$1,999	$2,099
Base configuration includes	384K RAM, 720K floppy disk drive, supertwist LCD	512K RAM, 720K floppy disk drive	640K RAM, two 720K floppy disk drives	640K RAM, two 720K floppy disk drives	640K RAM, two 720K floppy disk drives (no screen)	1MB RAM (640K RAM, 360K silicon disk), 720K 2-inch floppy disk drive	1MB RAM, two 720K floppy disk drives
Price of tested configuration	$2,195	$1,398	$1,295	$1,899	$2,998	$2,998	$2,999
Tested configuration includes	640K RAM, 20MB hard disk, 720K floppy disk drive, electroluminescent supertwist backlit LCD	512K RAM, 720K floppy disk drive, 768K RAM card	Same as base configuration	640K RAM, two 720K floppy disk drives, separate numeric keypad, modem	640K RAM, 20MB hard disk, 720K floppy disk drive, backlit LCD	2MB RAM (640K RAM, 1.36MB silicon disk), 720K 2-inch floppy disk drive, modem	1MB RAM, 20MB hard disk, 720K floppy disk drive, backlit LCD
Microprocessor	NEC V20	80C88	80C88	80C88	NEC V30	80C88	80C86
Speed (MHz)	4.77/9.54	4.77	8	4.77/8	4.77/10	4.77/8	4.77/9.54
Dimensions (HWD, inches)	2.5 x 13.2 x 13	2.1 x 12.2 x 11	2.2 x 13 x 12.2	2.4 x 12.6 x 11.4	3.1 x 13.6 x 12.2	1.3 x 12.4 x 9.8	2.6 x 12.2 x 12
Weight with battery pack (lbs.)	11.25	6.3	7.9	8.1	13.9	5.9	11
MEMORY							
Wait states	0	0	0	0	0	1	0
Minimum RAM	384K	512K	640K	640K	640K	1MB	1MB
Maximum RAM	640K	1.2MB	640K	640K	640K	2MB	2MB
EMS drivers	None	LIM 3.2 (with memory upgrade)	None	None	None	LIM 4.0	LIM 3.2
STORAGE							
Available hard disks	20MB	None	None	20MB	20MB	None	20MB
Optional external floppy disk drives:							
5.25-inch	360K ($495)	360K ($499)	None	None	None	360K ($399)	360K ($499)
3.5-inch	720K ($269)	None	None	None	None	720K ($299)	None
2-inch	None	None	None	None	None	720K ($349)	None
SCREEN							
Available screen types	Supertwist LCD or electroluminescent supertwist backlit LCD	Supertwist LCD	Supertwist LCD	Supertwist LCD	Supertwist LCD, with or without backlight	Backlit transflective LCD	Supertwist LCD, with or without backlight
Maximum resolution (pixels)	640 x 200	640 x 200	640 x 200	640 x 200	640 x 200	640 x 200	640 x 200
Video modes supported	CGA	CGA	CGA	CGA	CGA	CGA	CGA
Viewable area (W x H, inches)	9.5 x 4.25	9.5 x 3	8.75 x 3.75	8.25 x 3.1	9.4 x 4.1	8.4 x 3.1	8.75 x 3.75
Readability	Good	Fair	Fair	Fair	Fair	Good	Good
KEYBOARD							
Number of keys	77	82	81	76	85	80	82
Feel	Good	Fair	Good	Very good	Fair	Very good	Very good

The bright backlit CGA screen measures 8.25 by 4.5 inches and is quite legible. There was some distortion and ghosting at the bottom of the display, but two other UltraLites at *PC Magazine* were free of the distortion.

The UltraLite's 78-key keyboard has a .675-inch key center-to-center measurement, the equivalent spacing of a standard desktop keyboard. Due to its slim design, the keyboard has very short key travel with no give at the end of a key stroke, and the keys do not always fire unless hit directly from above. It has oversize Return, Backspace, and Backslash keys, and its cursor keys—which double as the Home, Pg Up, Pg Down, and End keys with the aid of a separate Fn key—are in an inverted T at the lower right. They are half-size, as are the Esc, Ins, Del, and the 12 function keys.

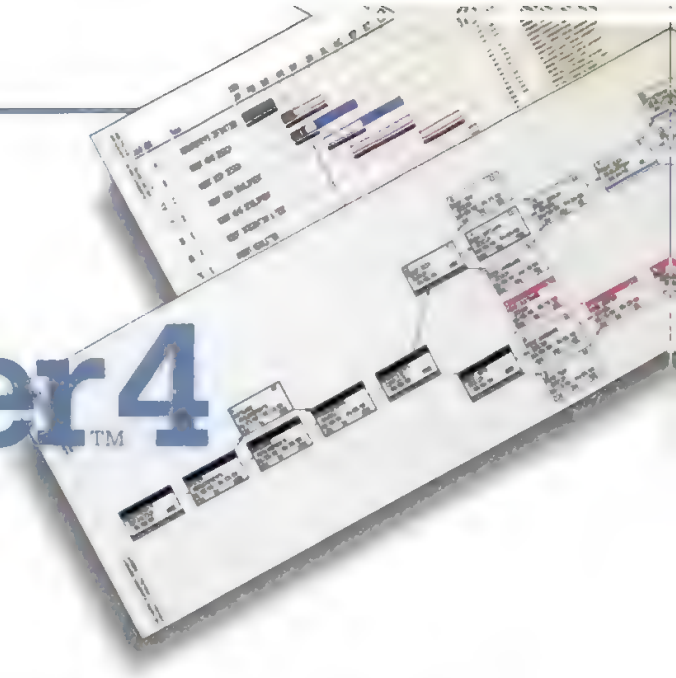
To maintain the UltraLite's thin shape, NEC sacrificed standard connections. The

GRiDLite XL	Sharp PC-4602	Datavue Snap 1+1	Zenith SupersPort	GRiD 140XT	NEC UltraLite	Sharp PC-4641	NEC MultiSpeed HD
$2,100	$2,195	$2,295	$2,399	$2,750	$2,999	$3,595	$3,699
128K RAM, 1.44MB floppy disk drive	640K RAM, two 720K floppy disk drives	640K RAM, two 720K floppy disk drives, supertwist backlit LCD	640K RAM, two 720K floppy disk drives	768K RAM, 20MB hard disk, 720K floppy disk drive	640K RAM, 1MB silicon disk, ROM/RAM card slot, modem	640K RAM, 40MB hard disk, 720K floppy disk drive	640K RAM, 20MB hard disk, 720K floppy disk drive
$4,430	$2,195	$2,295	$3,599	$2,750	$4,098	$3,595	$4,098
640K RAM, 20MB hard disk, 1.44MB external floppy disk drive, modem, carrying case	Same as base configuration	Same as base configuration	640K RAM, 20MB hard disk, 720K floppy disk drive	Same as base configuration	640K RAM, 2MB silicon disk, ROM/RAM card slot, 1.44MB external floppy disk drive, modem	Same as base configuration	640K RAM, 20MB hard disk, 720K floppy disk drive, modem
80C86	NEC V40	NEC V20	80C88	NEC V20	NEC V30	NEC V40	NEC V20
4.77/8	10	4.77/9.54	4.77/8	4.77/8	4.92/9.83	10	4.77/9.54
3 x 13.25 x 11.5	3.2 x 12.1 x 13.7	3.2 x 13 x 13	3.1 x 12.2 x 15.2	3.5 x 12.5 x 14.25	1.4 x 11.75 x 8.3	3.2 x 12.1 x 13.7	3.6 x 12.5 x 13.7
9.9	10.8	11.7	13.45	13.3	4.4	12.1	14.5
0	0	0	0	0	0	0	0, 1
128K	640K	640K	640K	768K	640K	640K	640K
2.1MB	1.6MB	1.6MB	1.6MB	768K	640K	1.6MB	640K
LIM 4.0	LIM 3.2	None	LIM 4.0	None	None	LIM 3.2	None
20MB	None	20MB	20MB	None	2MB silicon disk	None	None
360K ($395)	360K ($499)	None	360K ($399)	360K ($250)	None	360K ($499)	None
1.44MB ($350)	None	None	None	None	1.44MB ($399)	None	None
None	None	None	None	None	None	None	None
Film black-and-white reflective LCD	Supertwist backlit LCD	Supertwist backlit LCD, electroluminescent, or gas plasma	Supertwist backlit LCD	Supertwist backlit LCD	Electroluminescent backlit LCD	Supertwist backlit LCD	Electroluminescent supertwist backlit LCD
640 x 200	640 x 400	640 x 200	640 x 200	640 x 200	640 x 200	640 x 400	640 x 200
CGA	CGA, AT&T graphics, monochrome	CGA	CGA	CGA	CGA	CGA, AT&T graphics, monochrome	CGA
8 x 6	9 x 5.6	9.25 x 4.25	8 x 6.25	8.75 x 3.9	8.25 x 4.5	9 x 5.6	9 x 4.75
Fair	Very good	Good	Good	Good	Very good	Very good	Very good
71	90	84	78	76	78	90	85
Fair	Good	Good	Good	Good	Poor	Good	Very good

CONTINUES

Project Scheduler 4

The difference is graphically clear.™



Project Scheduler 4 set new industry standards for power, speed, and ease of use. Now Version 1.5 raises PC-based project management to an even higher level. In business after business, people are making the change to Project Scheduler 4. Why? The following comparisons make the reasons graphically clear.

Features	Project Scheduler 4	Time Line 3.0™
Gantt chart mode	•	•
Network chart mode	•	•
Spreadsheet mode	•	
Selectable Gantt graphics	•	
Fine grain summary Gantt charts	•	
Network chart automatic task placement	•	•
Multiple auto network draw algorithms	•	
Network chart interactive task placement	•	
Resource allocation & costing	•	•
Resource automatic time based cost inflation	•	
Resource calendars	•	
Automatic resource leveling	•	•
Interactive resource leveling	•	
Multiple project structures	•	
PERT schedule probability analysis	•	
Schedule & cost tracking	•	•
Independent multi-project support	•	
Integrated printer & plotter graphics	•	
Postscript graphics support	•	
Full data export	•	•
Full data import	•	

Benchmark	Product	Number of tasks 100	200	300	400	500
All times in seconds						
Schedule Recalculation	Project Scheduler 4	0.8	0.9	1.0	1.1	1.2
	Time Line 3.0	10.3	22.6	372.4	1024.8	1283.6
Display Network Chart	Project Scheduler 4	1.0	1.1	1.2	1.4	1.5
	Time Line 3.0	134.5	*	*	*	*
Load Project File	Project Scheduler 4	2.7	3.8	5.7	7.7	13.5
	Time Line 3.0	18.4	32.4	84.2	180.9	244.5
Save Project File	Project Scheduler 4	3.1	4.5	5.4	6.4	8.1
	Time Line 3.0	18.1	35.6	75.0	102.4	128.0

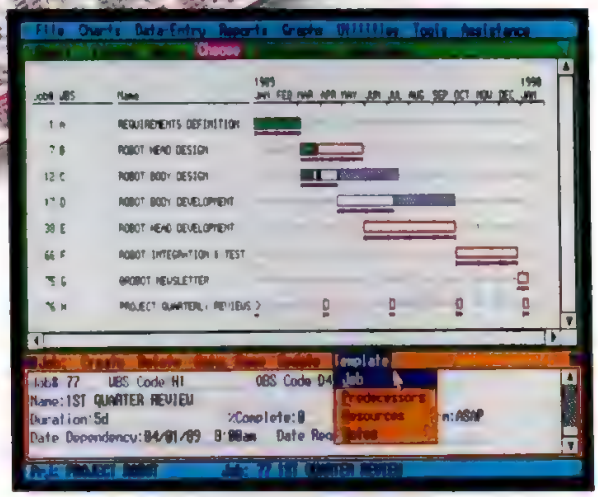
*After computing for over 12 minutes, Time Line displayed an "Unable to display Network View" message. All benchmarks were run on a 12 MHz 286 with 640k RAM.

Unmatched power at your fingertips.

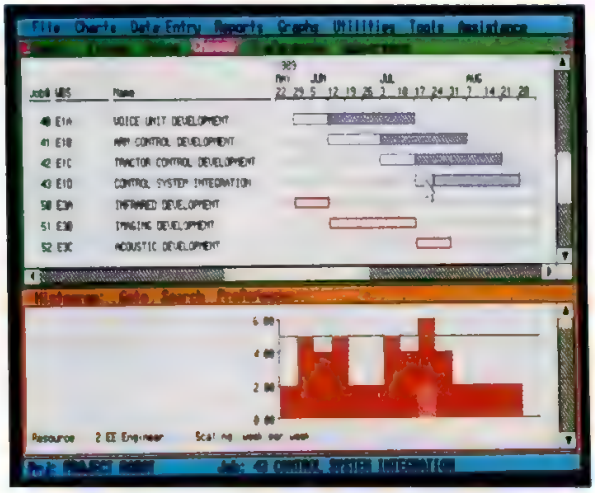
Project Scheduler 4 offers an impressive list of industry-leading power features. Projects are planned and tracked in a full graphics environment. You understand more because you see more on the screen. At last, PERT and Gantt charts make sense. Responsibilities, deadlines, and resource bottlenecks are spotted at a glance. You see more on paper, too. Beautiful, graphic reports print sideways, so you never have to cut and paste. They're instantly understandable. Not to mention simple to generate for impressive presentations.

Time-saving, world-class speed.

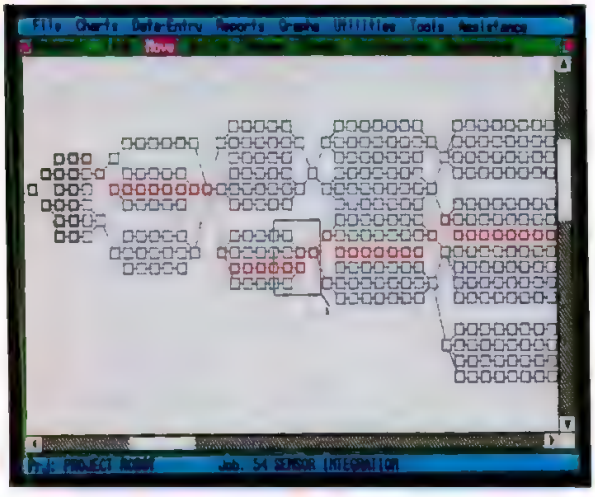
In benchmark tests, Project Scheduler 4 consistently outperforms all the competition as the fastest full-featured product in the industry—by a very wide margin. After all, what good are power features without the speed to make them useable. And the bigger your project, the more speed counts. Even at the 1000-task level, Project Scheduler 4 takes only 1.5 seconds to perform schedule recalculation. When your time is on the line, your project scheduler should help you manage it, not waste it.

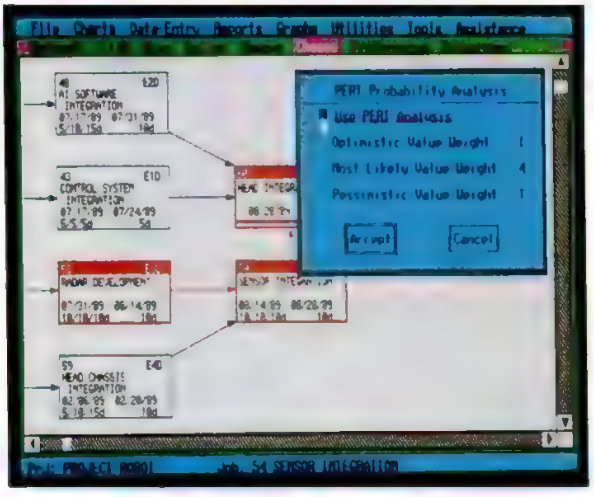


Project Scheduler 4 lets you view a Gantt chart in one window, while you enter or edit in another. Complete status information gives you a precise overview of your entire project. You control exactly what time scale is displayed: minutes, hours, days, weeks, months, or years. Display preferences include alternate symbols, free and total float, baseline, WBS and OBS filters, and much more.



In Gantt Histogram mode, a single mouse click quickly finds resource overloads and displays problem tasks. To see the planned resource utilization for a task, point at it in the Gantt chart, and the corresponding area in the histogram is automatically shaded. You may level resources interactively using Extend or Delay mode to eliminate resource overloads with a single click of the mouse.





Four reduced network zoom levels let you view the amount of detail you need to see. Each level provides drawing tools for positioning tasks in the network and changing predecessor relationships. When working with PERT analysis, Project Scheduler 4 lets you control probability weights and specify alternative task durations, while the program instantly recalculates the critical path.

Function	Project Scheduler 4	Time Line 3.0
Advanced graphical user interface	•	
On-line help	•	•
Step-by-step assist mode	•	
Full mouse support	•	

Time Line 3.0 is a registered trademark of Symantec Corp.

Exceptional ease and elegance.

Project Scheduler 4 offers sophistication that's simple to use. It's intuitive graphic interface gives you a clear overview of the entire scheduling process without hard-to-remember keystroke sequences. Ideal for beginners and experts, here is the future of advanced productivity tools.

Only Project Scheduler 4 offers the advanced graphics, high-speed performance, and ease of use you need to save time—and maximize productivity. For more information and a brochure, call or write:

415/570-7700

393 Vintage Park Drive
Suite 140
Foster City, CA 94404

Scitor Corporation

laptop has no parallel port, no external monitor port, and the serial port is a 9-pin DIN-style connection, with an extra cable to provide the typical 25-pin RS-232. Also at the back of the UltraLite are two RJ-11C connections for voice and data lines. These operate with the UltraLite's 2,400-bps internal modem, which is built into the motherboard and handles Hayes commands smoothly.

The machine uses two drives. Drive A: is the external 1.44MB 3.5-inch floppy disk drive, a $399 option. Drive B: takes removable memory cards, either ROM or RAM. Although the NEC cards look nearly identical to those made by Epson and Fujitsu, they use a different, proprietary pin connection. Storage cards have a capacity of 256K and sell for $299, while the ROM cards will be either 512K or 1MB. NEC has agreements with several software vendors to supply popular applications in

8088/86-BASED LAPTOP COMPUTERS: SUMMARY OF FEATURES

(Products listed in ascending price order)

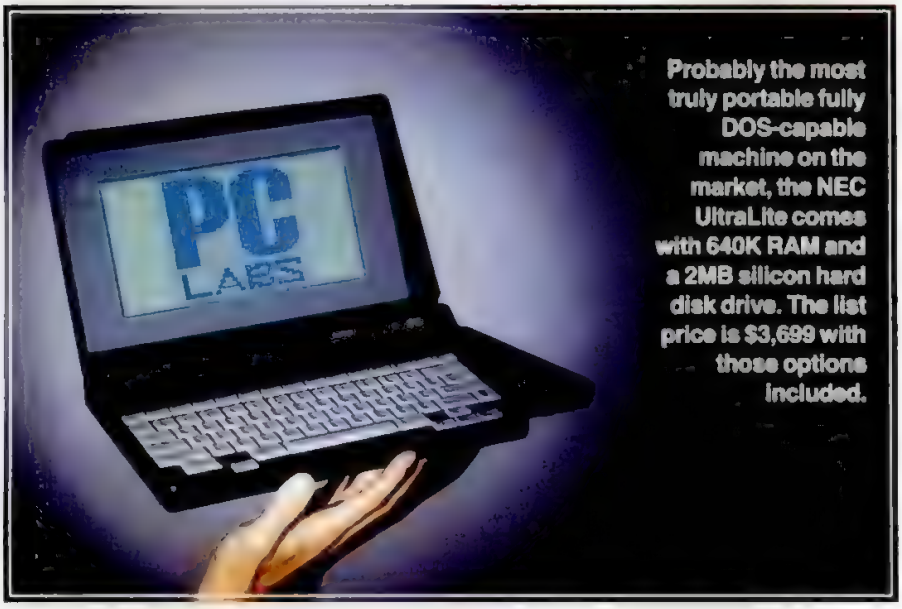
	Datavue Spark	Toshiba T1000	Bondwell B200	Sanyo MBC-16LT2	Epson Equity LT	Zenith MinisPort	Toshiba T1200
POWER							
Battery type	Nickel cadmium (removable)	Nickel cadmium (nonremovable)	Nickel cadmium (removable)	Nickel cadmium (nonremovable)	Nickel cadmium (nonremovable)	Nickel cadmium (removable)	Nickel cadmium (removable)
Claimed battery life (hours)	3–4	5	3–4	6	5	3–3.5	7
Charge time (hours)	8	Overnight	12	8	12	4–6	Overnight
Battery voltage	12V	4.8V	7.2V	4.8V	9.6V	12V	7.2V
Amperage (amperes/hour)	1.3	1.3	1.2	1.8	2	1.8	2.2
Car battery adapter	$225	$50	None	None	$59	None	None
Battery conservation techniques	Automatic drive and backlight turnoff, screen switch	None	Automatic LCD turnoff	None	Automatic drive and backlight turnoff	Automatic backlight turnoff, manual I/O turnoff	Automatic drive and backlight turnoff, hard disk switch, auto-resume
I/O AND EXPANSION							
External display types supported by built-in video hardware	CGA, monochrome composite	CGA, monochrome composite	CGA	CGA	CGA	CGA	CGA, monochrome composite
Ports	Serial, parallel, RGB and composite video, external floppy disk drive	Serial, parallel, RGB and composite video, external floppy disk drive, numeric keypad	Serial, parallel, RGB video	Serial, parallel, RGB video	Serial, parallel, RGB video, external floppy disk drive	Serial, parallel, RGB video, external floppy disk drive	Serial, parallel, RGB and composite video, external floppy disk drive, numeric keypad
Slot type	Modem	Modem	None	Modem	Two proprietary 8-bit	Modem, memory expansion	Modem ($349), expansion chassis ($399)
Speed of internal modem (bps)	1,200 ($325)	1,200 ($299), 2,400 ($399)	None	1,200 ($275), 2,400 ($335)	1,200 ($299)	1,200 ($199), 2,400 (pending)	1,200 ($299), 2,400 ($399)
STANDARD SOFTWARE							
Disk-based programs	DOS 2.11 (with floppy disk drive), DOS 3.3 (with hard disk)	*PC-Kwik PowerPak*	DOS 3.3, GW-BASIC	DOS 3.2, GW-BASIC	DOS 3.2, GW-BASIC (with tested configuration)	DOS 3.3, *FastLynx LX*	DOS 3.3, *PC-Kwik PowerPak*
ROM-based programs	*Teach Screen*	DOS 2.11	None	None	None	DOS 3.3, *FastLynx LX*	None
OPTIONS							
Math coprocessor	None	None	None	None	None	None	None
Carrying case	$75	$59	$100	None	$49	$59	$59

the ROM card format, however, these cards were unavailable at the time of this review. NEC and Lotus have announced that *1-2-3*, Release 2.01, will be available at the end of July for $495. That release is to be followed by *Agenda* and *Lotus Metro* with *Lotus Express*. Packages scheduled for late August release include Microsoft *Works*, *WordPerfect* 5.0, *WordStar* 5.5, and *XyWrite III Plus*.

The external A: drive works only when the AC adapter is attached; its connecting cable is a short 6 inches. As is obvious from the fact that NEC bundles *Lap-Link* in the UltraLite's ROM, it sees the 3.5-inch floppy disk drive as an optional, "leave with your desktop" peripheral. A NEC spokesman said that fewer than 40 percent of the units sold so far have included the add-on drive. The UltraLite's parallel port is located on the drive; alternatively, a dedicated parallel port adapter is

GRiDLite XL	Sharp PC-4602	Datavue Snap 1+1	Zenith SupersPort	GRiD 140XT	NEC UltraLite	Sharp PC-4641	NEC MultiSpeed HD
Nickel cadmium (removable)	Lead acid (nonremovable)	Nickel cadmium (removable)	Nickel cadmium (removable)	Nickel cadmium (removable)	Lithium for system, nickel cadmium for silicon disk (nonremovable)	Lead acid (nonremovable)	Nickel cadmium (nonremovable)
3–4	4	3–4	3	2.5–3	2	2.5	1–1.5
10	8	[illegible]	[illegible]	10	7–16	[illegible]	8
9.6V	6V	12V	12.5V	12V	12.6V	6V	9.6V
1.7	4.2	1.7	2.2	4.44	0.8	4.2	2.2
$25	None	$225	$19	$25	None	None	$20
Automatic drive turnoff	Automatic backlight turnoff	Automatic or manual display turnoff	Automatic drive, backlight, and modem turnoff	Automatic drive, backlight, and system turnoff	Automatic backlight turnoff	Automatic backlight turnoff	Automatic drive and backlight turnoff
CGA	CGA, monochrome	CGA, monochrome composite	CGA	CGA	CGA	CGA monochrome	CGA
Serial, parallel, RGB video, external floppy disk drive	Serial, parallel, RGB video	Serial, parallel, RGB and composite video	Serial, parallel, RGB video, internal modem, expansion chassis, numeric keypad	Serial, parallel, RGB video, external keyboard	Serial, external floppy disk drive, two RJ-11s	Serial, parallel, RGB video	Serial, parallel, RGB video, external floppy disk drive
Modem	Modem	8-bit ISA (half-length) in expansion module	Modem	Modem	None	Modem	Modem
2,400 ($525)	1,200 ($399), 2,400 ($449)	1,200 ($325)	1200 ($299), 2400 ($549)	2,400 ($300)	2,400 (included)	1,200 ($399), 2,400 ($449)	1,200 ($399), 2,400 ($499)
DOS 3.3	Diagnostics, DOS 3.3, GW-BASIC	Diagnostics, DOS 2.11	DOS 3.3	DOS 3.31	*Lap-Link* 2.1	Diagnostics, DOS 3.3, GW-BASIC	DOS 3.21
None	Setup	*Teach Screen*	Setup, diagnostics	None	DOS 3.3, *Lap-Link* 2.1, *MS-DOS Manager* 2.0	Setup	Setup, utilities (Dialer, Filer, Notepad, Outliner, Telecom)
8087 ($195)	None	None	8087-2 ($285)	8087-2 ($250)	None	None	None
$60	$75	$75	$59	$60	$129	$75	$129

ENDS



Probably the most truly portable fully DOS-capable machine on the market, the NEC UltraLite comes with 640K RAM and a 2MB silicon hard disk drive. The list price is $3,699 with those options included.

available for $199, using the same connection. NEC plans to offer additional peripherals that will use this general-purpose connection, including a SCSI interface adapter.

Originally introduced in November 1988, the UltraLite so far has been plagued by shortages. Besides the shortage of ROM cards previously alluded to, the machine itself has been in short supply because of chip shortages. Finally, its batteries have been in short supply, a problem exacerbated by the fact that they are short-lived and nonremoveable. The PC Labs battery rundown test of our review unit calculated its battery life at 1 hour and 21 minutes when run at 9.83 MHz. Its recharge time can last from 7 to 16 hours, although I found an average charge takes 8 to 9 hours.

The UltraLite heralds several remarkable technological advances. No other laptop can match its communications and computing power in such a small size.

Actually, the UltraLite already has two batteries. Besides the lithium molybdenum sulfide system battery already mentioned, it has a nickel cadmium unit that preserves the contents of the silicon hard disk for about a week. NEC's ample documentation has several warnings to leave the unit connected to its AC adapter whenever possible. You will have to lose your data only once to remember this important tip. Unlike your desktop's hard disk, any data files stored on the UltraLite's silicon hard disk are not permanent.

The battery situation is about to change, however: at press time NEC announced that the battery is going to be removable. The UltraLite implementing this feature, as well as a new glare-resistant screen, is scheduled for September shipment. A preview peak that NEC gave *PC Magazine* editors of the new screen showed it to be very good. Additionally, the price of this revised UltraLite should also be unproved. NEC tells us it will go down to $3,200 for the 2M silicon disk version in September. Replacement batteries will list for $119; an external battery recharger will sell for $199, and although it doesn't have a quick-charge provision, it can charge two system batteries simultaneously. Also, NEC will upgrade the original units so that their batteries are removable.

If portability and not price is your overriding concern, look no further. The new, revised UltraLite will give you so much computing muscle in such a small package, it will be the perfect companion for the ultimate power trip.

SANYO BUSINESS SYSTEMS CORP.

Sanyo MBC-16LT2

by Bruce Brown

Built around a battery that lasts nearly an hour longer than that of its nearest competitor, Sanyo Business Systems Corp.'s MBC-16LT2 comes near to being the ideal low-cost laptop. In addition to its excellent battery life, this truly lightweight laptop comes with a high-quality keyboard and is even reasonably priced.

For $1,399, the MBC-16LT2 gives you 640K RAM, two 3.5-inch 720K floppy disk drives, MS-DOS 3.2, and GW-BASIC 3.2. There is no hard disk version. The performance of its 8-MHz 80C88 chip is far from outstanding, placing the Sanyo in the bottom third of the machines, but none of these machines are all that speedy.

The MBC-16LT2 weighs only 8.1 pounds (including battery), making it one of the lightest laptops in this group. On the PC Labs battery rundown test, its rechargeable—but not removable—battery lasted an impressive 4 hours, 26 minutes. The battery takes about 8 hours to recharge, and the AC power supply and battery charger weigh an additional 1.6 pounds.

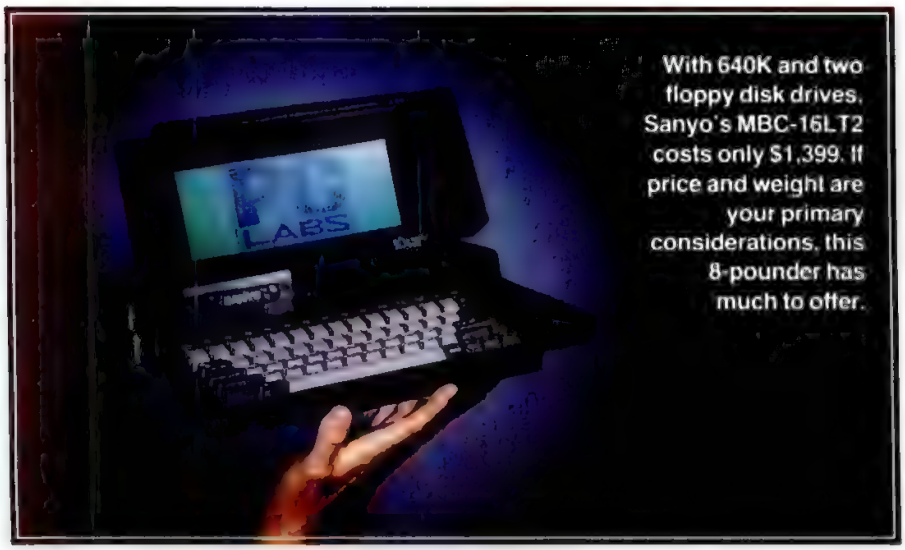
The laptop's 76-key keyboard has a very good action, as compared with that of the Toshiba 1200. There are separate cursor-control keys, but PgUp, PgDn, Home, and End are activated by holding the Shift key and striking cursor keys. The embedded numeric keypad is activated with the NumLock key.

The most disappointing feature of the Sanyo is its screen. A supertwist LCD that appears blue on gray, its viewable area

FACT FILE

Sanyo MBC-16LT2
Sanyo Business Systems Corp., 51 Joseph St., Moonachie, NJ 07074; (201) 440-9300, ext. 318; (800) 524-0047.
List Price: With 640K RAM, two 720K 3.5-inch floppy disk drives, DOS 3.2, $1,399; with internal 2,400-bps modem and separate numeric keypad, $1,889
In Short: Sanyo's MBC-16LT2 is a strong competitor for low-end laurels. The screen is only fair, but the keyboard is outstanding, and the features included for the price make this 7.9-pound machine a must-consider if weight and dollars are paramount.

CIRCLE 545 ON READER SERVICE CARD



With 640K and two floppy disk drives, Sanyo's MBC-16LT2 costs only $1,399. If price and weight are your primary considerations, this 8-pounder has much to offer.

measures 8.25 by 3.1 inches. Unfortunately, its characters are small and it has no backlighting, so you can't work with it in dim conditions. However, it does detach easily in case you want to plug an external CGA monitor into its 9-pin RGB port.

Overall, the MBC-16LT2 is aesthetically pleasing. Its elegant black case measures 2.4 by 12.6 by 11.4 inches (HWD) and features an exceptionally sturdy handle that slides into the front of the computer. Both floppy disk drives are on the right rear, while the power switch is on the left. The back of the computer includes one serial port, one parallel port, and a port for the external monitor.

The Sanyo MBC-16LT2 has no expansion slots, but there is a provision for an internal modem. Sanyo sells two—a 1,200-bit-per-second version for $275 and a 2,400-bps modem for $335. An external 34-key keypad sells for $145 and includes numeric, cursor-control, and function keys. The external keypad plugs into the parallel port but has a pass-through plug, so you can still hook up a parallel printer.

All in all, the MBC-16LT2 is a good value. Plagued with none of the problems that haunted the original Sanyo desktop machines, it compares favorably with both the Toshiba T1000 and Bondwell's B200. It's about 1.5 pounds heavier and $400 more expensive than the T1000 but has a better keyboard, longer battery life, more standard memory, and a second floppy disk drive. The similarly configured, equivalent-weight B200 has half the battery life and no provision for an internal modem.

Among traditional lightweight laptops, the Sanyo's closest competitor is the Datavue Spark, which comes with 640K, two floppy disk drives, and an electroluminescent screen. Since a Spark costs almost the same as the Sanyo but weighs approximately 2 pounds more and has a shorter battery life, the Sanyo can stand fairly proud.

If you can live without a hard disk and using a nonbacklit screen doesn't bother you, Sanyo's MBC-16LT2 is a good choice. Its light weight, long battery life, low price, and good keyboard may make it the ideal low-end buy.

SHARP ELECTRONICS CORP.

Sharp PC-4602, PC-4641

by Alfred Poor

Two new models from Sharp Electronics Corp. form the latest variations on its "PC-4600 portable" theme: the PC-4602 is a dual-floppy-disk system that lists for $2,195, while the PC-4641 has a 40MB hard disk and comes with a $3,595 price tag. As it turns out, there is a lot to like about these stylish siblings.

At first glance, the two machines look much like their competition. The familiar wedge case is made of charcoal-gray plastic and opens to reveal a fairly typical clamshell design measuring 3.1 by 12 by 13.5 inches (HWD). The screen comes up with the cheery blue glow of a supertwist backlit LCD and offers an aspect ratio just a bit flatter than standard. Pie charts will come out a little like egg charts, but not as severely squashed as they would be on some other popular portables. The screen has contrast and brightness controls, and screen positioning is easily adjustable to accommodate most lighting conditions.

The 3.5-inch floppy disk drives on both machines accept 720K disks. There is also a floppy disk port, allowing you to add an optional 5.25-inch external floppy disk drive that lists for $499. Both models also come standard with a parallel port and a 9-pin serial port. They even have a video adapter (standard in the U.S., optional in Europe) that can drive either a CGA or a monochrome external monitor. Both can accept either an internal modem (1,200 bits per second for $399, 2,400 bps for $449) or a second serial port ($99).

The machines also come with a standard 640K RAM (expandable to 1.6MB with support of the LIM 3.2 standard) and an easy and useful setup program in ROM that you can call up by pressing a key labeled Set Up. Diagnostics come standard on-disk, along with DOS 3.3 and GW-BASIC. The rechargeable lead battery can

FACT FILE

Sharp PC-4602
Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430-2135; (800)-BE-SHARP, (201) 529-9500
List Price: With 640K RAM, two 720K 3.5-inch floppy disk drives, DOS 3.3, GW-BASIC, $2,195. 1MB RAM upgrade, $599; external 5.25-inch floppy disk drive, $499; internal 1,200-bps modem, $399; 2,400-bps modem, $449; second serial interface, $99.

CIRCLE 546 ON READER SERVICE CARD

FACT FILE

Sharp PC-4641
Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430-2135; (800)-BE-SHARP, (201) 529-9500.
List Price: With 640K RAM, 40MB hard disk, 720K 3.5-inch floppy disk drive, DOS 3.3, GW-BASIC, $3,595. 1MB RAM upgrade, $599; external 5.25-inch floppy disk drive, $499; internal 1,200-bps modem, $399; 2,400-bps modem, $449; second serial interface, $99.
In Short: These machines are tough competitors. They offer average weight, good performance, and a bright double-scan CGA backlit supertwist screen. With list prices comparable to the rest of the field, both models represent attractive values.

CIRCLE 547 ON READER SERVICE CARD

Wanted Fo Murph

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BENCHMARK TESTS: 8088- AND 8086-BASED LAPTOPS

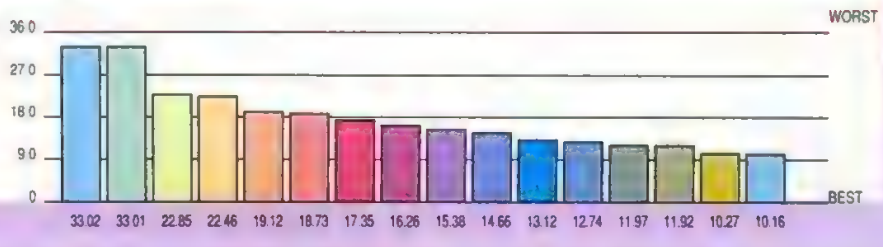
Among the laptop computers we examined, the NEC UltraLite is fastest across the board, with five first-place finishes in the processor and disk benchmark tests.

Epson and Sharp have the next-fastest processors, while the Sharp PC-4641, Datavue Spark, and GRiDLite XL are the fastest hard disk machines.

PROCESSOR AND MEMORY BENCHMARK TESTS

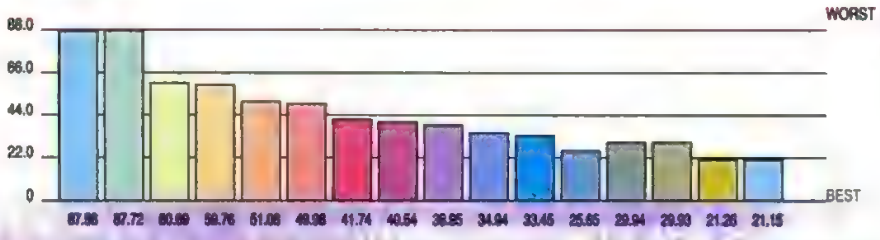
8088/8086 Instruction Mix — Elapsed Time (seconds)

The **8088/8086 Instruction Mix** benchmark test times a series of tasks for the 8088/8086 processor. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance



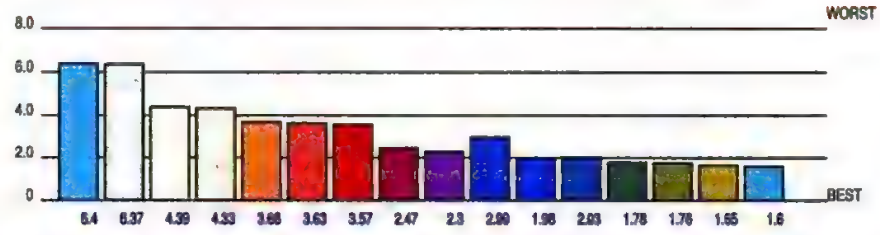
Floating-Point Calculation — Elapsed Time (seconds)

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory — Elapsed Time (seconds)

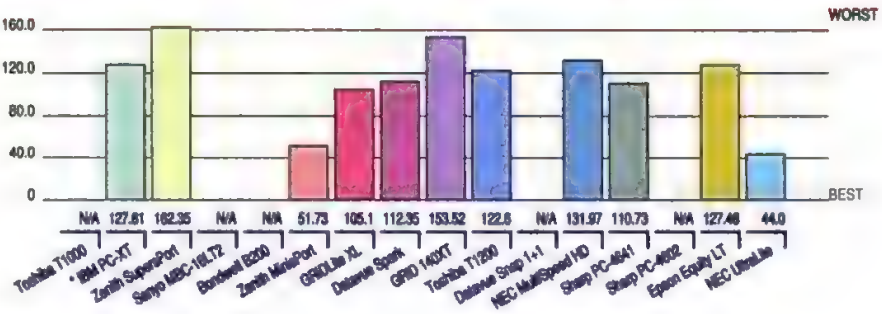
The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



DISK BENCHMARK TESTS

DOS File Access (Small Records) — Elapsed Time (seconds)

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



* For comparison only.
N/A—Not applicable: this computer does not have a hard disk.

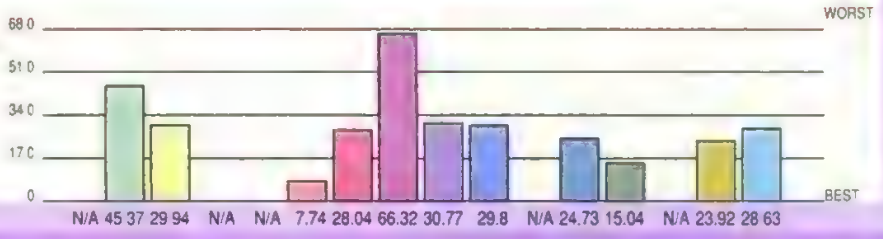
CONTINUES

BENCHMARK TESTS: 8088- AND 8086-BASED LAPTOPS

DOS File Access (Large Records)

Elapsed Time (seconds)

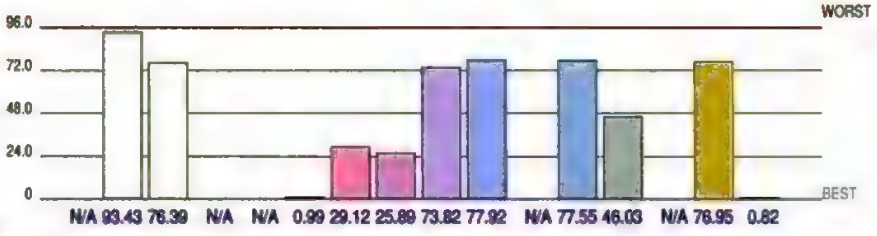
The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



BIOS Disk Seek

Elapsed Time (milliseconds)

The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.

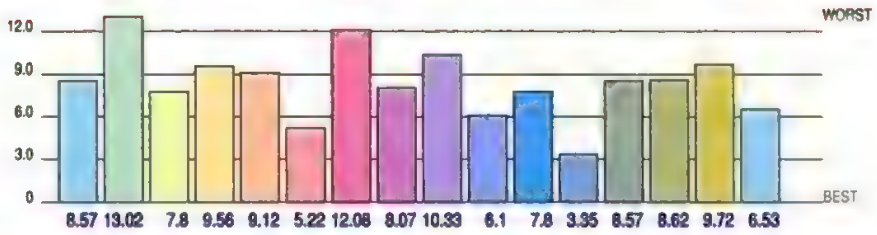


VIDEO BENCHMARK TESTS

Direct to Screen

Elapsed Time (seconds)

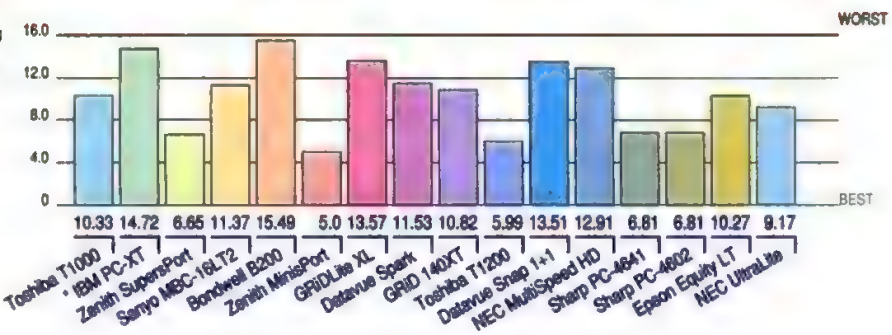
The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



Video BIOS Routine with Scrolling

Elapsed Time (seconds)

The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.



* For comparison only.
N/A—Not applicable: this computer does not have a hard disk.

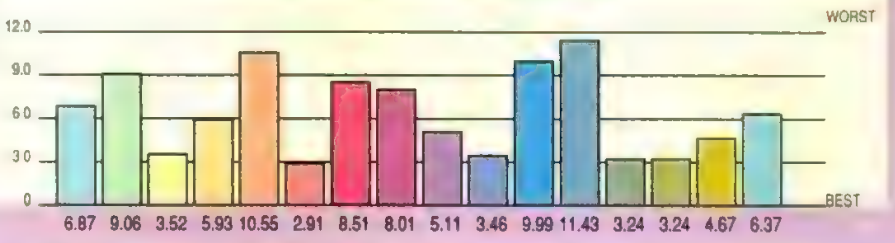
CONTINUES

BENCHMARK TESTS: 8088- AND 8086-BASED LAPTOPS

Video BIOS Routine Without Scrolling

Elapsed Time (seconds)

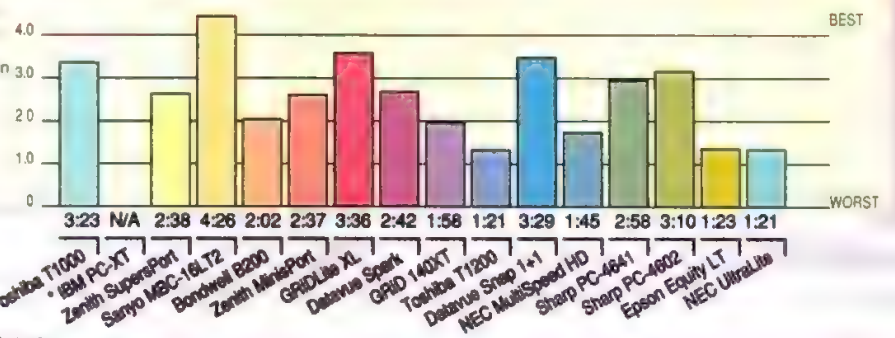
The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen



Battery Rundown

Elapsed Time (hours:minutes:seconds)

The **Battery Rundown** performance test involves teletyping five screens of text to the laptop's display, then writing a 15K file to the PC's hard disk once every minute until the battery runs out of power. Power conservation is disabled



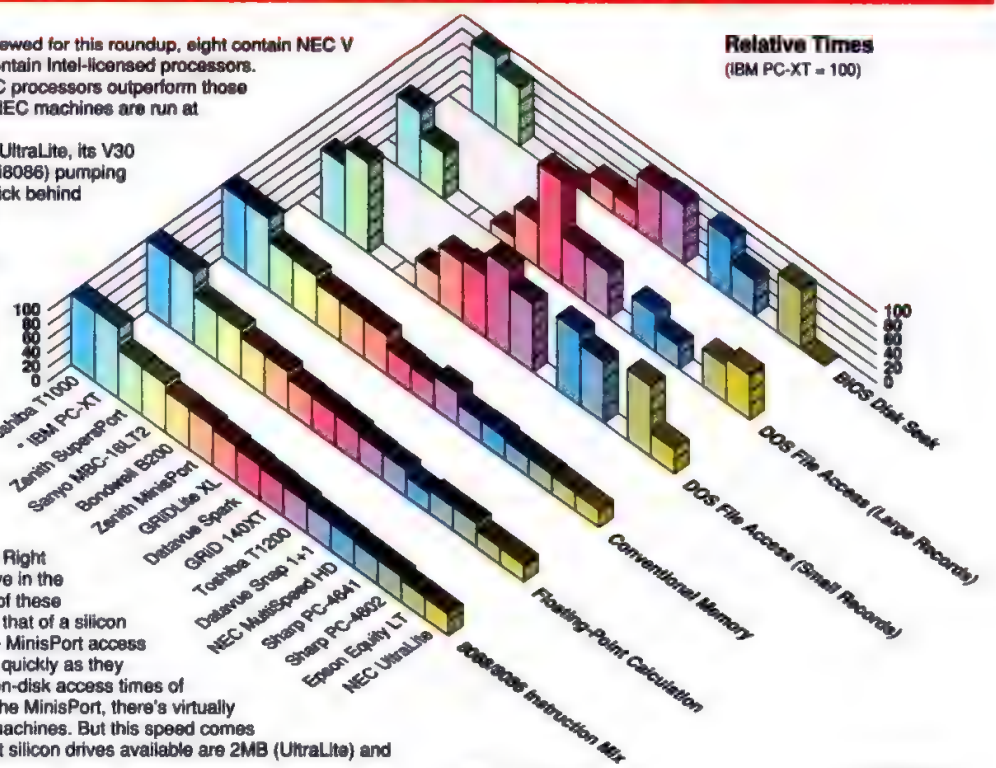
N/A—Not applicable: this computer does not run on batteries.

PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

Of the 15 laptop computers reviewed for this roundup, eight contain NEC V series processors and seven contain Intel-licensed processors. Overall, the machines deploying the NEC processors outperform those using the Intel processors because the NEC machines are run at higher speeds.

The performance winner is the NEC UltraLite, its V30 processor (functionally equivalent to the i8086) pumping out the instructions at 9.83 MHz. Just a tick behind is the Epson Equity LT, also with a V30 processor. The two Sharp machines follow the leaders, their V40 processors keeping them in the hunt. The V40 is a functional equivalent to the V20 and the i8088. The difference between the V40 and the V20 is in the level of integration; the V40 exploits such on-chip peripherals as a clock generator, bus arbitration, and asynchronous serial I/O control, making it an ideal choice for use in a laptop.

All of the laptops with hard disks outperformed the hard disk in the original IBM PC-XT. The Datavue Spark came out on top, its Conner hard disk posting a quick 25-millisecond time. Right behind was the 2.5-inch Prairie Tech drive in the GRiDLite XL, coming in at 29 ms. None of these hard disks' performance can compare to that of a silicon disk, however. Both the UltraLite and the MinisPort access data on their silicon RAM disks about as quickly as they access system RAM. With average silicon-disk access times of .82 ms. for the UltraLite and .99 ms. for the MinisPort, there's virtually no waiting to load programs with these machines. But this speed comes at the expense of capacity, as the largest silicon drives available are 2MB (UltraLite) and 1.3MB (MinisPort).



* For comparison only.

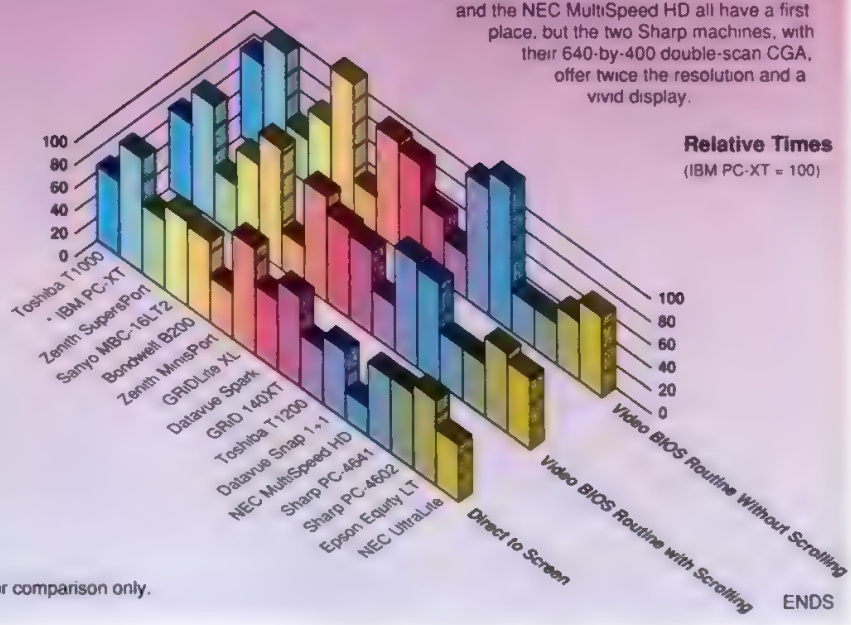
CONTINUES

VIDEO BENCHMARK TESTS: COMPOSITE VIEW

Battery life for the majority of these machines—all of which use low-power-consuming processors—was over 2 hours. The Sanyo MBC-16LT2 came out on top, running for an impressive 4 hours 26 minutes. The Sanyo, which is only available with floppy disk drives, owes its long runtime to a screen that does not employ backlighting. Backlighting typically consumes up to half of the power in a laptop battery. The GRiDLite XL was the champ of the hard disk units, its small Prairie Tech drive consuming less power than any of the other hard disks.

The three worst machines were the Toshiba T1200HB, Epson Equity LT, and NEC UltraLite. The Epson is the only laptop tested with an internal fan, and the fan contributed to its short battery life. The Toshiba's battery is rated at 7.2 volts and 2.2 amperes/hour—one of the smallest for the hard disk units tested—while the UltraLite comes with the smallest-capacity battery in this roundup, rated at only .8 aH.

The Sharp PC-4600s, the Toshiba T1200HB, and the NEC MultiSpeed HD all have a first place, but the two Sharp machines, with their 640-by-400 double-scan CGA, offer twice the resolution and a vivid display.



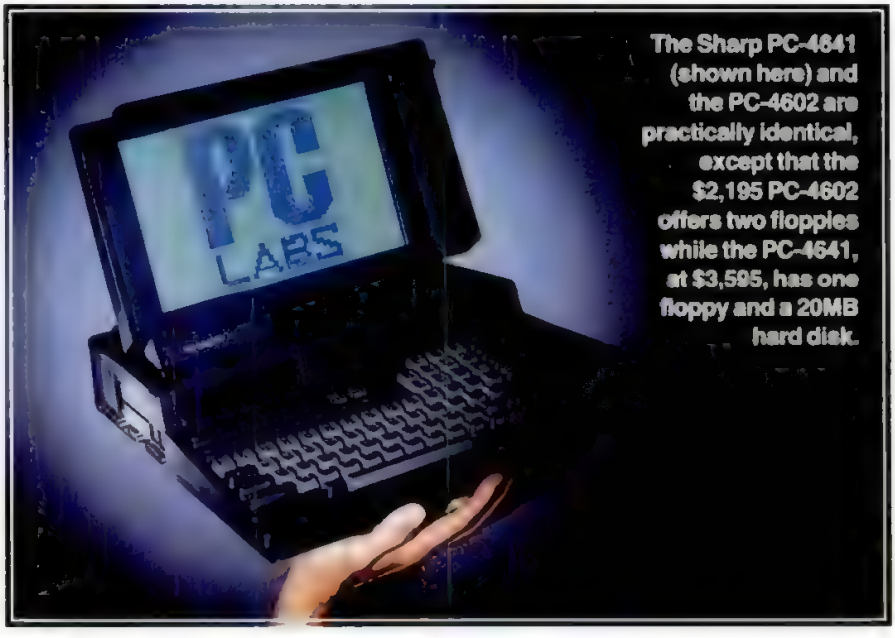
* For comparison only.

be removed in a jiffy using that common high-tech tool, a dime. You can purchase additional batteries for $40, allowing you reserve power for long flights. The only drawback to this is that you may have to rerun your setup program after changing batteries.

You may not need to swap batteries that often, however. In the PC Labs battery rundown tests, both models ran for about 3 hours, which places them above the average for the machines tested here and especially for those with hard disks.

The two Sharp PC-4600-series laptops differ in ways that really set them apart from the competition. These two machines have several endearing features.

One of these attractions lies at the heart of the PC-4600 series: its CPU is a NEC V40 chip running at a frenetic 10 MHz, giving the units a performance edge. The hard disk model, the PC-4641, pushes the performance advantage further by offering the third-fastest hard disk in its class, rated at 45 milliseconds. The difference between this and the typical 70-ms. hard disks was clearly brought out in the PC Labs benchmark tests. And if you want to boot without a disk, Sharp sells a $49 card that accepts six EPROM chips capable of being loaded with software from a floppy disk to create a permanent, read-only disk. However, since the chips are not offered by Sharp, you will have to purchase them yourself (about $150 to $200 total) and find a service that will load your software onto them for you.



The Sharp PC-4641 (shown here) and the PC-4602 are practically identical, except that the $2,195 PC-4602 offers two floppies while the PC-4641, at $3,595, has one floppy and a 20MB hard disk.

There is also a more visible advantage with the PC-4600s: their screens. They offer only CGA compatibility but use a double-scan technique that doubles their resolution. Instead of a 640 by 200 display, the Sharps produce images on a 640 by 400 matrix. Numbers can be deceiving, but seeing is believing, and one look will show you the dramatic difference.

The keyboard also offers some attractions. It's quiet and has a light touch but still manages to provide a gentle tactile feedback. Its designers have taken liberties with traditional layouts, but many users will find their changes appealing. The function keys are in the upper-left corner; an inverted T set of cursor keys is in the lower right. There are no separate PgUp,

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PgDn, Home, or End keys, but there are dedicated Ins and Del keys. You get one Alt key (next to the Spacebar) and one Ctrl key (above the left-hand Shift). The Shift keys are large, and the Enter Key is huge. With all of this, there is still room for a separate numeric keypad in the upper-right corner. It is a long reach, but much nicer to use than keyboards that require you to press special "function" keys to activate a keypad buried among the letter keys.

The Sharp PC-4600s differ in ways that really set them apart from the competition.

The major problem with the 4600's keyboard design is that the screen controls are easy to move by accident. They are mounted on the bottom-right edge of the case—right where you naturally grab the computer to move it off of one stack of papers and onto another. The controls would be better off mounted at the base of the screen, even if that isn't as pretty.

Compared with the other 808*x*-class laptops in the 10- to 15-pound range, the Sharps represent a good value. They are competitively priced and offer above-average performance. The large and fast drive on the hard disk model is especially attractive. So while it may appear that the two Sharp machines have a lot in common with the competition, the differences make them deserve your consideration.

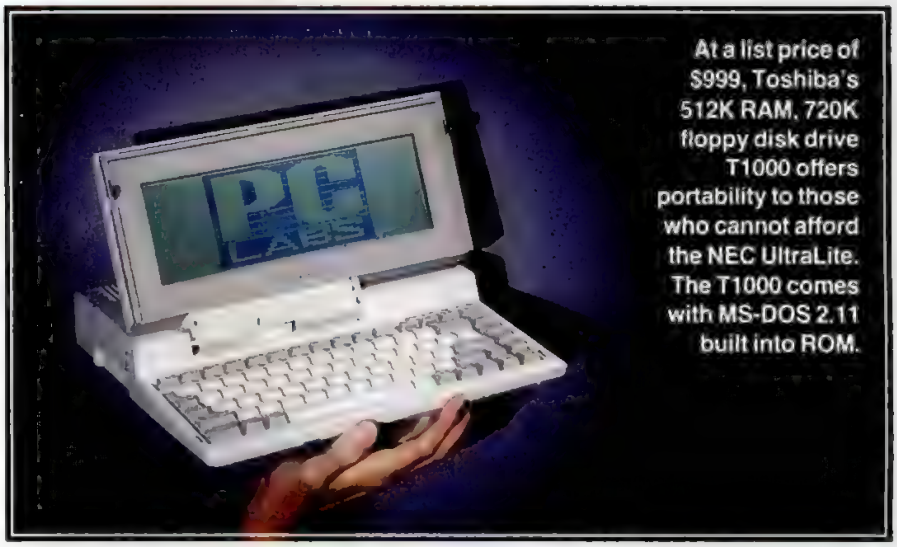
TOSHIBA AMERICA INFORMATION SYSTEMS INC.

Toshiba T1000

by Bruce Brown

In a sometimes-perplexing market that looks for standards but worships innovation, thereby demanding the newest as long as it's old, company and model track records count. Toshiba America Informations Systems' 8-bit T1000 has been on the market for 2 years, and it's the first laptop that comes to many people's minds when the topic is broached.

One on PC Magazine's Best of 1987 picks, the Toshiba T1000 still leads the pack of true MS-DOS laptops with its combination of light weight and low price. The T1000 offers the lowest base price of all the machines we reviewed ($999); the $1,398 unit that we tested came with a 768K RAM upgrade in addition to its 512K RAM and 3.5-inch floppy disk drive. The 4.77-MHz, 80C88 processor–controlled unit weighs 6.3 pounds (including battery) and measures 2 by 12.2 by 11 inches (HWD).



At a list price of $999, Toshiba's 512K RAM, 720K floppy disk drive T1000 offers portability to those who cannot afford the NEC UltraLite. The T1000 comes with MS-DOS 2.11 built into ROM.

The T1000 may have only one drive, but with MS-DOS 2.11 built into the unit's ROM, you can start it with nothing in the drive. The $399 768K RAM upgrade included in our test unit can be configured as either expanded memory with LIM 3.2–compatible EMS drivers, or as a RAMdisk, allowing you to use the floppy disk drive solely for data files.

The T1000's reflective supertwist LCD screen is only passable. Measuring only 9.5 by 3 inches and with a maximum screen resolution of 640 by 200 lines, the characters are cramped; backlighting would help. The T1000 has an RCA jack for composite monochrome and a 9-pin RGB jack for CGA.

The 82-key keyboard includes cursor-control keys and PgUp, PgDn, Home, and End. There are ten small function keys across the top and an embedded numeric keypad. The key action is fair; Toshiba knows how to make great keyboards, but there isn't enough room for longer key travel. The company also offers an optional $99 17-key external keypad.

The T1000's internal nickel cadmium battery is rated at 5 hours; in the PC Labs battery rundown test, it lasted for a respectable 3 hours, 22 minutes. Since the battery is not removable, forget buying extras for extended time away from AC power. The battery takes 8 to 10 hours to recharge, and a 12-volt car battery adapter costs $59.

Two internal Hayes-compatible modem options are available: a 1,200-bit-per-second version for $299 and a 2,4000-bps board for $399. Ports include one parallel and one serial, an external 5.25-inch floppy disk drive connection (the add-on itself costs $499), the two monitor ports, and the external keypad port.

The T1000 is smaller and lighter than most of the other computers in this series (save the NEC UltraLite and Zenith MiniPort) Although both of the latter are smaller, their $3000 and $2000 price tags place them in a different market. Toshiba is working on new, lighter machines, but until one of them materializes, the T1000 remains one of the best price/weight/battery-life combinations.

FACT FILE

Toshiba T1000
Toshiba America Information Systems Inc., Computer Systems Div., 9740 Irvine Blvd., Irvine, CA 92718; (714) 583-3000, (800) 457-7777.
List Price: With 512K RAM, one 720K 3.5-inch floppy disk drive, DOS 2.11, *PC-Kwik PowerPak* performance utilities, $999; with 768K RAM card, $1,398.
In Short: The T1000's new lower price keeps it competitive; hence its momentum as the low-end machine of choice will undoubtedly continue. The screen and keyboard are drawbacks, but its 6.4-pound weight, good battery life, and small size will help the T1000 stay on the road.

CIRCLE 548 ON READER SERVICE CARD

TOSHIBA AMERICA INFORMATION SYSTEMS INC.

Toshiba T1200

by Bruce Brown

If you can carry 11 pounds and don't mind spending at least $1,000 more, the 2.6- by 12.2- by 12-inch (HWD) Toshiba T1200 can give you a lot more functional capability than the T1000. Unfortunately, at least in the T1200 we tested, you must trade off battery life as well as price to gain functionality.

The T1200 comes in four varieties, all with a standard 1MB of RAM. The T1200HB, the model we tested, costs $2,999 and comes with 1MB RAM (it supports LIM 3.2), a 20MB hard disk, a 720K 3.5-inch floppy disk drive, and a backlit LCD screen.

The T1200's 8.75- by 3.75-inch backlit supertwist LCD screen is bright and legible. Don't settle for the nonbacklit variety. The 82-key keyboard is a standard among laptops; it feels solid and can take a beating. The T1200's keyboard arrangement is the same as that of the T1000, but the top row on the T1200 has full-size keys.

Battery life with the 80C86-based 4.77- or 9.54-MHz T1200 is not great. Rated at 7 hours for the two-floppy-disk version, PC Labs tested the 1200HB (hard disk and backlit version) and got only 1 hour, 20 minutes, from the nickel cadmium battery. However, since the battery is removable—it conveniently pops right out of the top—you can buy a bunch of extras at $79 each. Recharging them in the computer with the AC adapter is an overnight procedure, but Toshiba also sells an external battery recharger than can charge up to three batteries in 1.5 hours.

The T1200 also includes several ways to increase battery life, none of which were used in the PC Labs battery rundown test. There is a separate switch to turn off the hard disk; you can set up the hard disk and screen backlight to turn off automatically if not used; there's also a utility that tells you how much battery time remains.

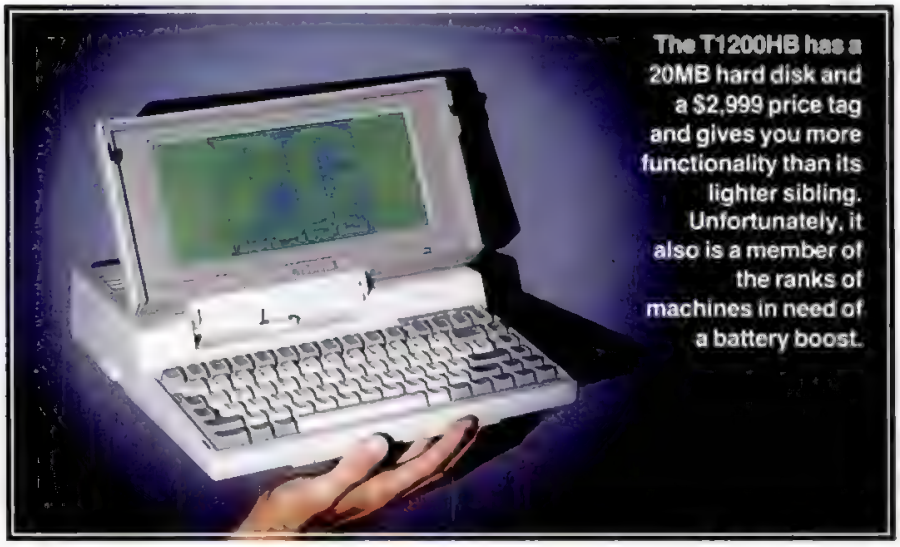
The T1200 comes standard with MS-DOS 3.3 and a *PC-Kwik PowerPak* selection of utilities, including caching, cursor speed-up, screen scrolling, and a "resume" mode that you can use to save your work in case your battery dies out in mid-application. When you power-up again, you're located right where you left off.

In addition to all the ports that come with the T1000, the T1200 has an internal slot for proprietary expansion cards. Toshiba sells an Ethernet card for the slot,

FACT FILE

Toshiba T1200
Toshiba America Information Systems Inc., Computer Systems Div., 9740 Irvine Blvd., Irvine, CA 92718; (714) 583-3000, (800) 457-7777.
List Price: Model T1200F, with 1MB RAM, two 720K floppy disk drives, DOS 3.3, *PC-Kwik* PowerPak performance utilities, $2,099; Model T1200HB, with 20MB hard disk, backlit screen, $2,999.
In Short: Toshiba's T1200 series comes in several flavors, with or without backlit screen and hard disk. The backlit screen is good and the keyboard is great, but the T1200 is showing its age. Practical battery life with the hard disk is less than an hour and a half.

CIRCLE 549 ON READER SERVICE CARD



The T1200HB has a 20MB hard disk and a $2,999 price tag and gives you more functionality than its lighter sibling. Unfortunately, it also is a member of the ranks of machines in need of a battery boost.

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User Defined Help	yes	no	no	no
Telecomm Services	yes	no	no	no
Desk Accessories	yes	no	no	no
Mouse Support	yes	no	yes	no
File search by name and content	yes	no	no	no
Encrypt/decrypt files	yes	yes	no	no
Screen saver	yes	yes	no	no
All memory available to user application	yes	yes	no	no
Password Protection	yes	yes	yes	no
Unlimited menus	yes	no	yes	no

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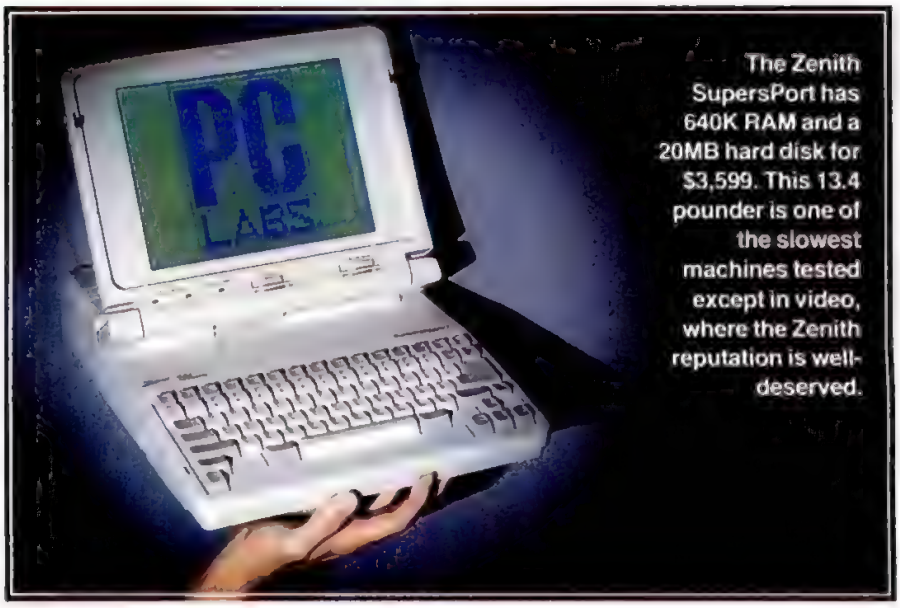
and third-party vendors offer other cards. You could fill the expansion slot with a $399 2,400-bit-per-second modem, but it wouldn't make much sense to, since Toshiba also offers a $349 2,400-bps modem that fits into a separate modem slot.

Though the T1200's price is in line with the pricing on bigger machines from vendors such as Zenith and NEC, don't forget that Toshibas are often discounted heavily. If you can find a hard-disk-equipped T1200 in the $2,000 range, it might be worth buying (along with a few extra batteries and an external adapter).



The Zenith SupersPort has 640K RAM and a 20MB hard disk for $3,599. This 13.4 pounder is one of the slowest machines tested except in video, where the Zenith reputation is well-deserved.

ZENITH DATA SYSTEMS

Zenith SupersPort

by Alfred Poor

You can find a great deal to like about the Zenith SupersPort: great screen, decent battery life, reasonable price, interesting options. There's also plenty to gripe about.

Compared with first-generation battery laptops, the 13.4-pound SupersPort is fantastic. Besides being striking, its bright-blue supertwist LCD screen, which offers CGA resolution, is adjustable to meet the needs of a wide range of lighting conditions. It has a viewable area of 8 by 6.25 inches and is hinged at two points on each side, so it can lie totally flat and out of the way if you want to use an external screen. It even makes hooking up such a monitor easy by having a built-in display adapter and supplying a key combination (marked on a keycap) that will toggle between the LCD and the external port.

The SupersPort comes with a battery that clips on to the back of the unit. This means that you can leave the extra 2.5 pounds behind when you don't intend to compute beyond the reach of a wall plug. Battery life, as measured by the PC Labs battery rundown test, is a reasonable 2 hours, 38 minutes. An external recharger sells for $89, while a 12-volt car battery adapter costs $19. If you do use the battery while the computer is plugged in, the unit will still draw its power from the battery, which in turn is charged by the power cord. The net result is that you get a standby power supply built into the machine.

Although the SupersPort starts at $2,399 for a dual 720K 3.5-inch floppy disk drive model, the version we tested came with one floppy disk drive and a 20MB hard disk for a less-than-moderate $3,599. Both configurations come with 640K RAM, but you can add 1MB of memory (the SupersPort supports LIM 4.0). A three-slot expansion chassis costs $499, and an 8-MHz 8087 math coprocessor sells for $285. Zenith's optional 1,200-bit-per-second internal modem is $299, and the 2,400-bps modem lists for $549.

FACT FILE

The 78-key keyboard offers an inverted T set of cursor controls, with PgUp, PgDn, Home, and End activated by a blue Fn shift key. The numeric keypad is embedded and also works with the Fn key. The keyboard has a light but acceptable feedback.

When you compare the SupersPort to what the current generation of laptops has to offer, it comes up a bit short. On the PC Labs benchmark tests, the hard disk performance was unexceptional and the processor times slow.

Another problem stems from a design decision intended as a protective measure. The SupersPort comes with all the standard ports—parallel, serial, video, and external disk drive—found on most machines in its class; these connectors are located inside a little hatch that protects them—just as it does on its larger sibling, the SupersPort 286. However, since you cannot open or shut the hatch once the battery is in place (you must first turn off the machine and disconnect the battery), you must decide whether or not to use the ports before you hook on the battery. This is not the easy-to-use design most users have in mind when they think of laptops.

A year or two ago, the SupersPort was a top competitor in its class. Time and technology march on, however, and the SupersPort is beginning to drop behind the new leaders. For some people, it will be a perfect blend of price, performance, and features. For many others, however, there will be more attractive alternatives.

ZENITH DATA SYSTEMS

Zenith MinisPort

by Alfred Poor

The promise of laptop computing is a machine small enough to go anywhere yet powerful enough to be useful. The problem of laptop computing today is that the concepts of "small enough" and "powerful enough" are subjective and mean very different things to different people. As a

FACT FILE

Zenith MinisPort
Zenith Data Systems, 1000 Milwaukee Ave., Glenview, IL 60025; (800) 553-0331.
List Price: With 1MB RAM, one 720K 2-inch floppy disk drive, 1 parallel and 1 serial port, 1 external 3.5-inch floppy-disk-drive port, MS-DOS 3.3 and *FastLynx* in ROM; $1,999; with 2MB RAM; $2,799. 1,200-bps internal modem, $199; additional battery pack, $79; carrying case, $59.
In Short: The MinisPort adds low volume and weight to an impressive list of standard features and expansion options and sets the pace for the growing market of notebook computers, all at a surprisingly low price.

CIRCLE 601 ON READER SERVICE CARD

result, we have a wide range of machines that hit these fuzzy targets with fuzzy results.

For many users, the solution has become much clearer. Zenith has introduced its MinisPort, and with a list price of $1,999 for a 1MB configuration—which includes a 720K 2-inch floppy disk drive; DOS 3.3 and *FastLynx* in ROM; plus parallel, serial, and extra floppy ports—this newest entry in the lightweight sweepstakes stands to be a big hit. The version we tested offers the same configuration with 2MB of RAM (in both versions the 640K is standard dynamic RAM, and the remainder is battery-backed for use as a silicon disk or EMS memory) and sells for $2,799; we added in a $199 1200-bps internal modem (2400-bps models were unavailable at review time), bringing the cost of our test unit to $2,998.

The MinisPort is not for everyone. It has no hard disk, even as an option, so if you need 20MB of data and programs online at all times, look elsewhere. The LCD screen does not have a standard aspect ratio, so you won't want a MinisPort for heavy graphics use because the images will be vertically compressed.

Aside from these two limitations, the MinisPort is arguably the best value on the market for truly portable computing. If you can live with applications that fit on essentially proprietary 720K floppies, this may be the machine for you.

It is small and light. Its surface is about the size of a presentation folder, and the case is a skinny 1.3 inches thick. The base model tips the scales at about 5.9 pounds (the model we tested weighed 6.2 lbs.), which is about 1.5 lbs. more than the UltraLite, the lightest machine tested here, but still light enough not to be a burden.

It is ruggedly built. The case has a substantial metal base and extra protection in essential places like behind the LCD screen. Zenith engineers apparently gave durability a higher priority than absolute minimum weight—the right choice.

The keyboard is full-size, with .75-inch key cap spacing, just like on desktop keyboards. The key caps themselves are only half as tall, but they are sculpted and even have raised dots on the F and J home-row keys. The keys have about half the travel of the average desktop keyboard but still have a good feel, offering a firm tactile response. The Enter, Backspace, and Shift keys are all extra wide. There is an inverted T set of cursor control keys and an embedded numeric keypad that is activated by an Fn key.

Aside from its small size and weight, the MinisPort's biggest strength is its storage. It has DOS 3.3 in ROM, which makes boot-up fast and easy. Whether you purchase the base model with 1MB of RAM or the 2MB configuration, the first 640K is assigned to system memory and the balance can be used as a nonvolatile silicon disk or as expanded memory. If the system storage gets full, you can save your work on 720K floppies.

The Zenith MinisPort is small and light. Its surface is about the size of a presentation folder, and it tips the scales at just 5.9 pounds. It is also ruggedly built.

The MinisPort is the only one of the machines in this lineup to use 2-inch floppy disks. They look like 3.5-inch disks that were shrunk. If you get a MinisPort, you will probably use the 2-inch disks only to store data and applications for use on the machine. (Zenith sells ten-pack boxes of these for $99.) It comes with *FastLynx* in ROM—a self-cloning file transfer utility to make it fast and easy to move data to and from a desktop machine. Or, you can get

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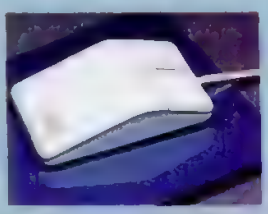

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Data World Data 386-20
May 30, 1989

Dataworld's DATA 386-20 and DATA 386-25 stand out in the 20- and 25-MHz categories for speed and quality construction." (May 30, 1989)

PC MAGAZINE — EDITOR'S CHOICE
Data World Data 386-25
May 30, 1989

"The Dataworld Data 386-20 minitower and Data 386 full-size tower are good values and first-rate performers from an up-and-coming mail-order firm...

PC MAGAZINE — EDITOR'S CHOICE
Data World Data 386-16
February 28, 1989

"The Dataworld offers a 16-bit video system with a top-quality NEC Multisync II monitor and an exceptionally fast disk-drive controller for an impressive combination of value and performance... from a vendor with an increasing reputation for quality." (Feb. 28, 1989), 16 MHz system.

PC MAGAZINE — EDITOR'S CHOICE
Data World Portacomp II
October 11, 1988

"The Portacomp II is a value leader with fast memory, a fast drive controller and a terrific keyboard... Marvelously cheap powerful alternative... outperformed the other 286's. (Oct. 11, 1988)

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STANDARD CONFIGURATION

- Intel 80386-20 microprocessor
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- NEC Multisync II monitor capable of 1024x768 interlaced
- Socket for Intel 80387 numeric coprocessor
- 1 32-bit, 1 8-bit and 6 16-bit slots
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- 1.44MB 3.5" diskette drive

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STANDARD CONFIGURATION

- Intel 80386-25 microprocessor
- 1MB base memory RAM, expandable to 16MB of 32-bit memory
- 64K of 25ns static RAM cache
- 66MB, 25ns Hard Disk (many other sizes available as an option)
- Orchid Prodesigner Plus VGA card. 512K capable of 1024x768 with 16 colors
- NEC Multisync II monitor capable of 1024x768 interlaced
- Built-in ROM setup and diagnostics with EGA/VGA relocation
- Socket for Intel 80387-25 or Weitek numeric coprocessor
- 1 32-bit, 8 16-bit and 1 8-bit slots
- 1:1 dual hard/floppy controller
- 1.2MB 5.25" floppy drive
- Enhanced 101-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

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DATA 386-16^M / -20^M / -25^M

STANDARD CONFIGURATION

- Intel 80386-16, or -20, or -25 microprocessor
- 1MB base RAM, expandable to 16MB of 32-bit memory
- LIM EMS 4.0 driver supplied
- 25 MHz system features Intel 82385 cache controller with 32K 2-way set associative static cache
- 65MB, 25ms Hard Disk (many other sizes available as an option)
- Orchid Prodesigner Plus VGA card. 512K capable of 1024x768 with 16 colors
- NEC Multisync II monitor capable of 1024x768 interlaced
- Socket for Intel 80387 numeric coprocessor
- 1 32-bit, 5 16-bit and 2 8-bit slots
- 1:1 dual hard/floppy controller
- 1.2MB 5.25" floppy drive
- Enhanced 101-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 230W power supply

AVAILABLE OPTIONS

- Full-size vertical case
- RAM upgrade to 2-, 4-, 8-, 12-, or 16-MB
- Numeric coprocessor: 80387
- 20MB to 300MB hard drives with MFM, RLL, ESDI, or SCSI interface
- 40MB - 120MB tape backup drives
- Available in standard monochrome (720x348, amber), standard VGA (640x480, color) or extended VGA (800x600 up to 1024x768, color)
- 1.44MB 3.5" diskette drive

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- Dual hard/floppy controller
- 1.44MB 3.5" internal AND 1.2MB 5.25" external diskette drives
- 20MB, 48ms hard drive
- Enhanced 102-key "click" touch keyboard
- 1 parallel and 2 serial ports
- 9-pin external monitor output port - EGA
- 150W power supply

AVAILABLE OPTIONS

- 16MHz available soon
- Memory expansion to 640K, 1MB, 2MB, or 4MB
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EDITOR'S CHOICE

Just shy of the mark

Of the 15 8088/8086-based battery-powered laptop portables in this review, most are past their prime and a bit thick around the middle at 10 to 15 pounds. Two others, the light but pricey NEC UltraLite and Zenith MinisPort, could be the class of the field with a few improvements, and the Toshiba T1000 represents an intriguing value if you can live with its screen. These three are our favorites, but they're not good enough to merit Editor's Choice.

To get the most out of today's DOS applications in a portable, you need a 286-based laptop, and that's where you'll find most of the advances in the DOS-to-travel arena (see "286 Laptops Compute en Route," *PC Magazine*, July 1989): VGA and EGA screens, 1.44 MB floppy disk drives, removable batteries, fast 40MB hard disk options, and sophisticated power management.

Improvements to the 8088/8086 market have been few, except in the under-7-pound notebook class. Even so, the bulkier 8088/8086 laptops do capable jobs running integrated software and spreadsheets, fetching e-mail, and managing sales-contact software. At $1,000 to $1,500 (street price) for dual-floppy-disk versions and $1,500 to $2,000 with 20MB hard disks, they'll get the job done. (In contrast, 20MB 286 portables will cost you $2,500 to $3,500.) Although none of the machines we reviewed particularly stands out, you won't be dissatisfied with the Toshiba T1200, Zenith SupersPort, and Sharp PC-4602, among others. Also, watch for rebates and bundled software that lower the final cost (and may help clear the shelves for replacement models).

Since these sub-286 machines won't be powerful, at least they can be light (under 7 pounds) and compact (little bigger than a notebook). The diskless NEC UltraLite is the most technically advanced of the remaining three and won a *PC Magazine* Award for Technical Excellence last fall. It's 12 by 8 inches and 4.5 pounds with a 5 by 8 backlit screen and a 2,400-bit-per-second modem standard. The version you want, with a 2MB silicon hard disk, is $3,700 list (about $2,600 street price). What the UltraLite isn't, unfortunately, is finished: the serial port uses a nonstandard connector, the keyboard doesn't feel right, the batteries are difficult to remove, NEC has been slow to deliver software on slip-in ROM cards, and our test model ran only an hour per charge. (Other UltraLites used by *PC Magazine* return about 1.5 to 2 hours per charge.) This fall, NEC will ship a revised UltraLite with a quick-change battery, external charger, and improved screen for $3,200 list for the 2MB version.

Zenith's brand-new MiniSport is slightly but noticeably bulkier: 12 by 10 inches, 6 pounds; it lists for $3,000 with a 2MB silicon disk and a 1,200-bps modem (2,400-bps is promised but not delivered). The removable battery operates 2.5 hours per charge, the keyboard feels better than NEC's, and there's a 2-inch 720K floppy disk—intended more for removable data storage than for data transfer. (To move data to other PCs with both the NEC and Zenith, you use the included serial-port transfer programs.) The screen is smallish, 3 by 8 inches, and it's transflective: partly backlit, partly lit by reflective light. It's worse indoors, better outdoors, than the UltraLite. If you want briefcase computing, the MinisPort comes up just a bit short.

Technically excellent when introduced two and a half years ago, the Toshiba T1000 remains a terrific deal for some people. It has a single 720K floppy disk drive and, with the 768K add-on silicon drive (recommended), it's less than $1,000 street price. But it measures 11 by 12 inches and weighs 6.5 pounds, and the 3 by 10 screen squashes graphics and lacks illumination.

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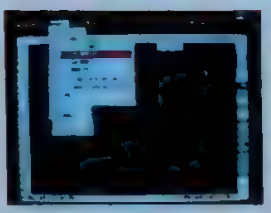

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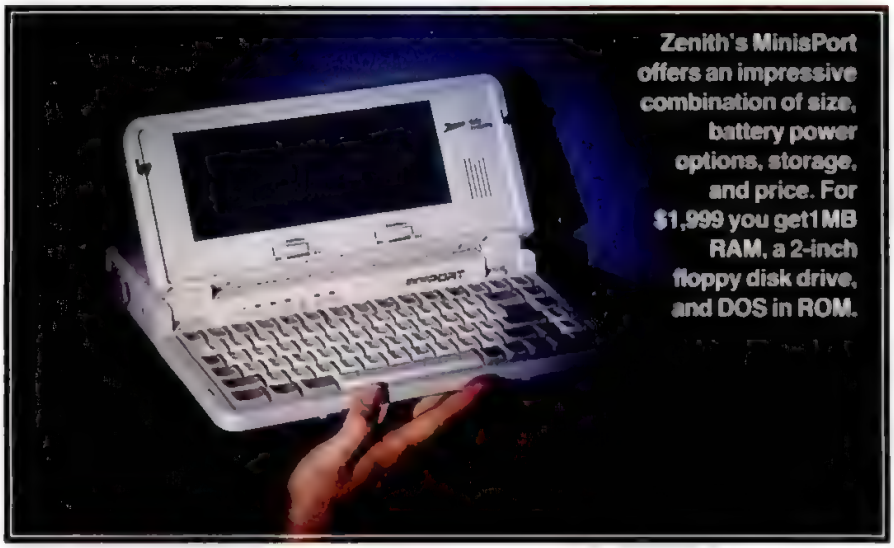

Zenith's MinisPort offers an impressive combination of size, battery power options, storage, and price. For $1,999 you get 1 MB RAM, a 2-inch floppy disk drive, and DOS in ROM.

an external 3.5-inch disk drive (1.5 pounds, $299) that will run off the MinisPort's battery and use 3.5-inch disks.

The MinisPort's 10-ounce cassette-encased batteries are easily removable (list price $79). In the PC Labs battery rundown tests, the machine ran a bit longer than 2.5 hours on a charge; thanks to some clever power-management aids, you can expect a charge to last longer under typical use. A battery pack can recharge in about 3 hours and can be charged outside of the computer.

Possibly the weakest link in the MinisPort's chain of impressive features is its 8.25 by 3.125 screen. Besides a backlight that can be turned off to save power, the laptop's supertwist LCD screen has a reflective "DayBright" coating behind the LCD layer that lets it use ambient light. Though this, too, helps save power, the downside is that the screen is not as bright as the ones that have only a backlight. On the plus side, the screen is legible under conditions ranging from total darkness to full sunlight.

In the end, you will go for the MinisPort for these reasons: light weight, removable storage media, compactness, the length of running time per battery charge, and its low cost. Pick one up, and you may never want to put it down. ■

Alfred Poor is a contributing editor of PC Magazine *and an industry analyst who does much of his work in an electronic cottage in Perkasie, Pennsylvania. Bruce Brown is a frequent contributor to* PC Magazine *who works as a computer consultant in Simsbury, Connecticut. Matt Ross coordinates the computer reviews for the features department at* PC Magazine. *He is an assistant editor.*

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Video and Hardware Configurations:

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EGA	$1,599	$1,899	$1,999
VGA	$1,799	$1,999	$2,199

Free *ACCESS* Software Utilities Included

ACCESS 386/16

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- Eight slots: (1-32 bit, 5-16 bit, 2-8 bit)
- One parallel, serial and game port.
- 102-key "AT" style enhanced keyboard.
- 1.2MB Hi-density 5¼" floppy drive.
- Five ½ height drive bays.
- 220 watt high capacity power supply.
- Phoenix Compatible BIOS.
- Clock/Calendar with Battery Back-up.

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Video and Hardware Configurations:

386/16	40MB-28ms	80MB-28ms	159MB-28ms
Mono	$2,299	$2,499	$3,299
EGA	$2,699	$2,899	$3,699
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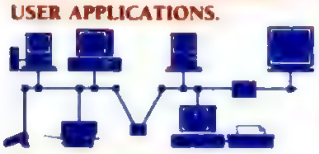

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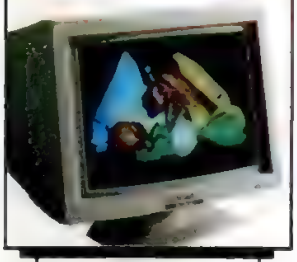

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Lab Notes

OS/2—A Rich Communications Environment

As you'll recall from our last issue, DOS makes life difficult for communications programmers. Because its primitive AUX serial device driver is not interrupt driven, high-speed DOS communications programs must supply their own code and logic to interface with the serial port. DOSTERM, the bare-bones terminal emulator presented in the previous issue, does little more than read, write, and display characters; yet even these simple tasks require some fairly advanced programming techniques.

By contrast, OS/2 presents a rich environment for communications programs. The OS/2-supplied serial device driver provides all of the low-level services a commercial-quality communications program needs for high-speed character input and output. There are no interrupt service routines to worry about, no programming of the Universal Asynchronous Receiver/Transmitter (UART) or the interrupt controller chips, and no extra effort necessary to implement sophisticated handshaking and flow-control schemes. The driver handles all of these functions internally, effectively insulating the application program from the chores of direct device management.

OS2TERM, the OS/2 equivalent of DOSTERM, highlights the differences between the DOS and OS/2 communications programming environments. Both programs (which can be downloaded from PC MagNet) provide you with simple but fully functional terminal emulators. Indeed, if you connect a DOS machine and an OS/2 machine with a null modem cable and run DOSTERM on one and OS2TERM on the other, you'll find that the two PCs talk to each other—a seemingly trivial feat until you realize that you have electronically bridged the gap between two quite different operating systems.

■ This second and concluding part gives you a guided tour through the OS/2 communications facilities and a practical example of an OS/2 terminal emulator.

THE OS/2 SERIAL DEVICE DRIVER

Before getting to OS2TERM, however, we should consider the OS/2 communications facilities that it uses. The OS/2 serial device driver comprises two files, which are placed in the OS2 subdirectory of the hard disk drive during installation. The first, COM01.SYS, provides serial-device support for AT-class machines. The second, COM02.SYS, is used with PS/2 machines.

Unlike AUX, which is loaded by default every time DOS is initialized, the OS/2 drivers must be loaded with a DEVICE command in the CONFIG.SYS file. A single DEVICE statement, however, loads as many copies of the driver as there are COM ports installed in the system. COM01.SYS supports up to two serial ports, which are assigned the logical names COM1 and COM2; COM02.SYS supports up to three.

The COM0*x*.SYS device drivers are fully interrupt driven. Since normal OS/2 application programs run at privilege level 3 in the 80286/80386 protected-mode environment—and thus cannot service system interrupts—the operating system itself handles all interrupts generated by the UART hardware. All incoming characters go first into a 1,024-byte internal buffer. Outgoing characters are temporarily stored in a 128-byte internal buffer before being delivered to the UART's transmit hardware. The sizes of both buffers are fixed and cannot be altered by an application program.

Characters are passed between these buffers and a user's application space at the program's request. Although functions are provided for determining the number of characters awaiting processing in the input and output queues, the *OS/2 Programmer's Reference* warns that the mechanisms used for moving data in and out of them may change in subsequent releases. As a result, programs should not be written to rely upon this information.

Hardware handshaking at the RS-232 control pins can either be performed by the application program or can be delegated to the device driver. The COM0*x*.SYS drivers offer a variety of handshaking modes that are handled transparently at the device driver level. This allows application programs to ignore control pin states and concern themselves with nothing more than reading and writing bytes of data. In one mode, for example, known as *RTS toggle-on-transmit* mode, the RTS (Request to Send) pin is automatically asserted when data is moved into the transmit buffer and held until the buffer is emptied. We'll examine the entire array of handshaking options in detail later in this article.

If desired, COM0*x*.SYS will provide automatic transmit and receive flow control using the XON/XOFF protocol. If receive flow control is enabled, the device driver transmits an XOFF character when the 1,024-byte serial input queue is almost

full. XON is transmitted when enough characters have been read to leave the queue about half empty. (To accommodate systems that expect XON to be the first character following XOFF, all other output is inhibited until after the XON character is sent.) With transmit flow control activated, the device driver responds to the receipt of an XOFF character by disabling output until XON is received. Both the XON and XOFF character codes used by the drivers are user programmable.

THE DOSDEVIOCTL FUNCTION

The DosDevIOCtl function is used to query and configure device drivers under OS/2. Of the roughly 90 subfunctions provided for direct device support, 20 apply to the serial device driver. This superset is divided into 10 categories, one for each device that the DosDevIOCtl function supports. The category code is passed along with the desired function code when DosDevIOCtl is invoked. Serial-device support functions belong to category 1.

Figure 1 lists the DosDevIOCtl serial port services; for most, name denotes function. SETBAUDRATE, for example, permits an OS/2 application to set the serial device driver's data rate, while GETBAUDRATE returns the current data rate. You'll recall that, in the last issue, setting the data rate under DOS required a direct write to the UART registers or a call to the BIOS through interrupt 14h. Under OS/2, SETLINECTRL sets the driver's line-control characteristics: the number of data bits, the number of stop bits, and the parity setting. GETINQUECOUNT and GETOUTQUECOUNT return values to the calling program that reflect the number of characters awaiting processing in the device driver's internal receive and transmit queues.

By far the most complex of the DosDevIOCtl serial port functions are SETDCBINFO and GETDCBINFO. These functions allow programs to manipulate values in the device driver's DCB (Device Control Block). The DCB is the block of information that determines the device driver's behavior. Specifically, the components of the DCB structure define such critical communications parameters as what binary values are used for the XON/XOFF characters, what the read and write timeout values will be, and what handshaking strategies will be employed.

The DCB structure shown in Figure 2 has the following form:

```
struct {
      USHORT usWriteTimeout;
      USHORT usReadTimeout;
      BYTE bFlags1;
      BYTE bFlags2;
      BYTE bFlags3;
      BYTE bErrorReplacementChar;
      BYTE bBreakReplacementChar;
      BYTE bXONChar;
      BYTE bXOFFChar;
};
```

The SETDCBINFO and GETDCBINFO function codes and the address of a DCB structure are passed as arguments to DosDevIOCtl.

The usWriteTimeout and usReadTimeout variables are 16-bit values that define timeout values. These are expressed in hundredths of a second, where 0 represents 0.01 seconds, 1 represents 0.02 seconds, and so on. The variables bErrorReplacementChar and bBreakReplacementChar define the Error and BREAK replacement characters. Similarly, bXONChar and bXOFFChar define the XON and XOFF characters used when XON/XOFF flow control is activated.

The bFlags variables are further subdivided into bit fields, as detailed in Figure 3. They control such additional device-related parameters as handshaking modes, flow control, and read and write timeout processing strategies.

Detailed consideration of the various DCB elements and of their effects on the operation of the serial device driver is best handled in connection with specific topics as they arise. We will also discuss a subset of DosDevIOCtl's serial port functions, although the scope and complexity of the entire set preclude treating all of them here. For further reference, refer to the "I/O Control Functions" section of the OS/2 SDK or Programmer's Toolkit *OS/2 Programmer's Reference* manuals or to Ray Duncan's *Advanced OS/2 Programming* (Microsoft Press, 1989).

READING AND WRITING

The OS/2 kernel API functions treat a serial port like a file. It is opened for reading

CONFIGURING SERIAL PORTS UNDER OS/2

Code	Function	Description
0x41	SETBAUDRATE	Set baud rate
0x42	SETLINECTRL	Set line-control characteristics
0x44	TRANSMITIMM	Transmit immediately
0x45	SETBREAKOFF	End BREAK signal
0x46	SETMODEMCTRL	Set modem-control output states
0x47	STOPTRANSMIT	Stop transmitting
0x48	STARTTRANSMIT	Start transmitting
0x4B	SETBREAKON	Send BREAK signal
0x53	SETDCBINFO	Set Device Control Block parameters
0x61	GETBAUDRATE	Get baud rate
0x62	GETLINECTRL	Get line-control characteristics
0x64	GETCOMMSTATUS	Get communication status
0x65	GETLINESTATUS	Get transmit data status
0x66	GETMODEMOUTPUT	Get modem-control output states
0x67	GETMODEMINPUT	Get modem-control input states
0x68	GETINQUECOUNT	Get number of characters in input queue
0x69	GETOUTQUECOUNT	Get number of characters in output queue
0x6D	GETCOMMERROR	Get UART error word
0x72	GETCOMMEVENT	Get UART event word
0x73	GETDCBINFO	Get Device Control Block parameters

Figure 1: Twenty of the approximately 90 DosDevIOCtl functions support serial devices and are used to query and configure serial ports. For most, their names denote their functions.

IN-LINE CODE

Beginning this issue, we will tint *only* successive lines of in-text code that you should enter as one continuous line. As usual, the indentation of any secondary lines indicates the number of spaces you should include when typing multiple lines as a single entry. If a line is not indented, do not include any spaces.

and writing with OS/2's standard DosOpen function and closed with DosClose. It is read and written with DosRead and DosWrite. And, like all other resources that OS/2 allocates on a per-process basis, a serial port is automatically closed when DosExit is invoked to terminate a process.

Of the parameters passed to DosOpen, only szFileName, hf, and fOpenMode (these are the designations used in the Microsoft SDK *Programmer's Reference* manual) have any meaning in terms of opening a serial port. Such variables as usAction, ulFileSize, usAttribute, and fOpenFlags (which indicate what action DosOpen took when it opened the file, the new file size, the attributes assigned to a newly created file, and the action to be taken if the file doesn't exist) are unknown to COM0*x*.SYS.

The filename string, szFileName, is used to open a serial port. The string must be COM1, COM2, or COM3 for the three serial ports, respectively. The file handle, hf, returned by DosOpen is used in all subsequent references to the port. Like a file, a serial port may be opened with a combination of read and write access rights and with a number of restrictions placed on other processes that attempt to utilize it.

A serial port is normally opened with both read and write privileges for the process that opened it. This is done by setting the least-significant two bits of the fOpenMode word to 0x0002. Bits 4, 5, and 6 are used to specify the share mode: 0x0010 for deny-read-write, 0x0020 for deny-write, 0x0030 for deny-read, and 0x0040 for deny-none.

A serial port opened in deny-read-write share mode cannot be opened by another process running in OS/2; attempting to do so will return a sharing violation error (error code 32) from DosOpen. A serial port opened in deny-none share mode, however, can be accessed by other programs. But there is an inherent danger in doing this: a stream of data pouring in from a serial device will be split between programs running simultaneously—even if the data was intended for only one. Each process will see only the characters that were received during its time slice (or, more precisely, the characters that were transferred from the input queue to satisfy a DosRead request during its time slice).

Thus, to protect data streams from being corrupted by background processes, safety dictates opening a serial port in a multitasking environment in deny-read-write mode. Should you have occasion to run two communications programs at once, the most reliable way to multitask them is to assign each one its own COM port.

During normal processing, if a DosWrite request is made but a byte of data can't be delivered to the transmit hardware within the time specified in the usWriteTimeout field of the DCB structure, DosWrite times out and returns. The number of bytes transmitted before the request was completed can be determined from the bytes-written variable, whose address was passed to DosWrite. The timeout value can be changed with a call to DosDevIOCtl's SETDCBINFO function.

The alternative to this form of write processing is what the OS/2 documentation terms *write infinite* processing. In the write infinite mode, DosWrite won't return until the number of bytes specified are transmitted. Which write mode is in effect at any given time is determined by the state of bit 0 in the bFlags3 field of the DCB structure. When this bit is set, write infinite processing is used; when bit 0 is clear, the timeout value found in usWriteTimeout is applied.

OS/2 offers three different modes of read processing. Like the write processing modes, these are controlled by the application program through SETDCBINFO. Setting bit 1 of bFlags3 in the DCB structure effects *normal* read timeout processing, setting bit 2 invokes *wait-for-something* reads, and setting both causes OS/2's serial device driver to employ a *no-wait* read strategy.

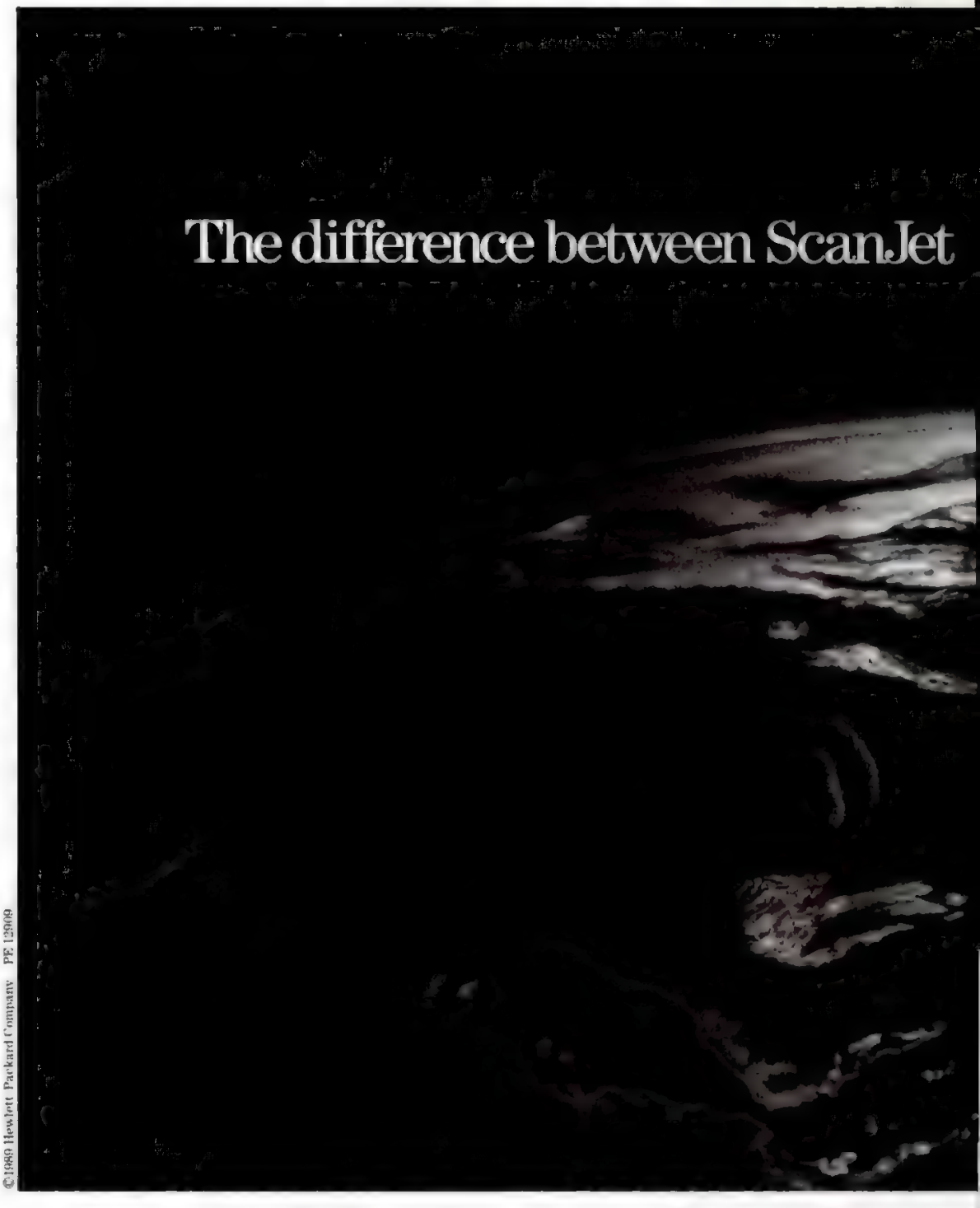
The first, *normal* read timeout processing, is analogous to the normal write processing mode for transmitting bytes of data. DosRead returns when the specified number of bytes have been read from the input queue or when a single byte hasn't been received for the duration of the timeout interval specified in usReadTimeout.

In the second, *wait-for-something* form of read processing, COM0*x*.SYS waits (up to the amount of time specified in the

MANAGING THE OS/2 SERIAL DEVICE DRIVER

Field	Description
usWriteTimeout	Write timeout (100ths of a second)
usReadTimeout	Read timeout (100ths of a second)
bFlags1	**See Figure 3**
bFlags2	See Figure 3
bFlags3	See Figure 3
bErrorReplacementChar	Error character code
bBreakReplacementChar	BREAK character code
bXONChar	XON character code
bXOFFChar	XOFF character code

Figure 2: The DCB (Device Control Block) defines parameters that are critical to the operation of a communications program, such as the binary values for the XOFF/XON characters, the read and write timeout values, and the handshaking strategies. You can change these values by using the DosDevIOCtl functions SETDCBINFO and GETDCBINFO.



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usReadTimeout field) for data to appear in the queue. It then returns immediately, regardless of how many bytes were requested. Thus, for example, if 1 byte of data is returned when a DosRead call is made with wait-for-something read processing in effect, and 5 more bytes are received in the meantime, the next call to DosRead will return all 5 bytes. If there had initially been no data in the input queue, DosRead would have waited for the first byte to appear.

The difference between wait-for-something read processing and normal read timeout is most easily understood by considering another example. If a DosRead call was executed with a request for 10 characters and only 5 bytes were received, with normal read processing in effect DosRead would not return until the timeout counter expired after receipt of the fifth byte. With wait-for-something reads, however, the same DosRead call would return immediately, even though the full 10 bytes hadn't been read.

With *no-wait* read processing in effect, DosRead does not wait for character data to appear in the input queue. Rather, it checks the queue for characters, processes what's there, and returns immediately. If there is nothing in the queue, DosRead will indicate this fact by returning a bytes-read value of 0. If there are characters in the queue, all of them (up to the maximum number specified when DosRead was invoked) are processed.

Which forms of read and write timeout processing are best to use depends upon your application. At startup, the serial device driver defaults to normal reads and writes, with 60-second timeouts. Many communications programmers, however, choose wait-for-something reads, which are the most time-efficient. No-wait reads impose a high amount of overhead on the application program—too much, in fact, for them to be employed in a time-critical thread.

When dealing with output, many communications programmers are inclined to employ normal write timeout processing. The reason is that this mode provides a fallback when something that is external to the program—the serial device driver's receipt of an XOFF character, for example, or the failure of the receiving device to assert CTS (Clear to Send) when expected—has temporarily blocked further transmission.

The OS2TERM program that is furnished here provides an illustration of how an application program can make use of DosDev IOCtl's DCB funcations to set the operating parameters that the device driver will utilize. The call to SETDCBINFO is preceded by a call to GETDCBINFO to fill in the DCB control structure (labeled DCBInfo in OS2TERM.C). The timeout and flags fields are then modified to suit the needs of the program and SETDCBINFO is called. OS2TERM uses wait-for-something reads and normal writes with 60-second timeout periods to pass data to and from the serial port. One minute is enough time to keep timeout periods from interfering with the normal flow of execution but it is short enough so that it still should prevent the program from hanging in case disaster strikes.

THE BFLAGS VARIABLES

Field	Bits	Description
bFlags1	0x01	Enable DTR control mode
	0x02	Enable DTR input handshaking mode
	0x04	Undefined
	0x08	Enable output handshaking using CTS
	0x10	Enable output handshaking using DSR
	0x20	Enable output handshaking using DCD
	0x40	Enable input handshaking using DSR
	0x80	Undefined
bFlags2	0x01	Enable XON/XOFF transmit flow control
	0x02	Enable XON/XOFF receive flow control
	0x04	Enable Error replacement character
	0x08	Enable null stripping
	0x10	Enable BREAK replacement character
	0x20	Undefined
	0x40	Enable RTS control mode
	0x80	Enable RTS input handshaking mode
	0xC0*	Enable RTS toggle-on-transmit mode
bFlags3	0x01	Enable infinite write timeouts
	0x02	Enable normal read timeouts
	0x04	Enable wait-for-something read timeouts
	0x06*	Enable no-wait read timeouts
	0x08	Undefined
	0x10	Undefined
	0x20	Undefined
	0x40	Undefined
	0x80	Undefined

* Obtained by setting combinations of other control bits.

Figure 3: The bFlags parameters are subdivided into bit fields that control additional device-related parameters such as handshaking and flow control. Being able to change the bFlags at the bit level gives you much greater control over the behavior of the serial device driver.

HANDSHAKING

The OS/2 serial device driver can use a variety of protocols for automatic handshaking with devices on the other end of the line. By default, when a serial port is first opened, DTR (Data Terminal Ready) and RTS are permanently asserted, and output handshaking is performed using CTS and DSR (Data Set Ready). Under these conditions, any input received while DSR is inhibited is treated by the driver as extraneous and is ignored. Any and all of these parameters can be changed, however. It is up to the OS/2 application program to know the characteristics of the serial hard-

ware with which it is exchanging information and to set the handshaking modes accordingly.

Output handshaking using CTS, DSR, and DCD (Data Carrier Detect) can be enabled by setting any combination of bits 3, 4, and 5 in the bFlags1 field. With output handshaking enabled, data will not be transmitted from the 128-byte output queue unless the corresponding pin is held high by the receiving device. With bits 3 and 4 set, for example (the default configuration), OS/2 will not output characters unless the DCE (Data Communications Equipment) has asserted both CTS and DSR. DCD handshaking is used only in special circumstances.

Bit 6 of the DCB structure's bFlags1 field controls DSR input *sensitivity*. With sensitivity enabled, the device driver discards any characters received while DSR is not asserted. Since this is the default operating mode, an OS/2 communications program must either make sure that the transmitting device asserts DSR before it puts data on the line, or it must use SETDCBINFO to disable input sensitivity. OS2TERM takes the latter course, first calling GETDCBINFO to obtain default parameter values, then clearing bit 6 before calling SETDCBINFO. This process eliminates any dependence on DSR.

Bits 0 and 1 of bFlags1 and bits 6 and 7 of bFlags2 are used to control the device driver's handling of the DTR and RTS control pins, respectively. In each case, clearing both bits disables the corresponding control signal; setting the lower bit while leaving the higher one clear enables the signal; and clearing the lower bit and setting the higher bit activates *input handshaking* for the corresponding pin. With the first two settings, DTR and RTS are simply inhibited or asserted by the device driver. They remain so until SETDCBINFO is called again to alter them or until the application program manually toggles them by using DosDevIOCtl's SETMODEMCTRL function. In all cases, DTR and RTS can be set independently.

In *DTR input handshaking* mode, the device driver assumes control of DTR, toggling it on and off as needed to control the flow to the receive queue. DTR is asserted when the queue is less than half full and is inhibited when the queue approaches capacity. This setup achieves the same effect as an XON/XOFF protocol implemented in hardware rather than software. *RTS input handshaking* mode does the same for RTS—all pin voltages are handled automatically by the device driver.

The final handshaking option is *RTS toggle-on-transmit* mode, which is activated by setting bits 6 and 7 in bFlags2. In this mode, the device driver asserts RTS when data in the output queue is awaiting transmission and inhibits it when the queue is emptied. This handshaking scheme is particularly useful when the hardware on the receiving end will not transmit data while RTS (or CTS on the DCE end) is held high but won't accept data unless it is. With toggle-on-transmit, RTS is asserted only when it needs to be—namely, when the device driver is requesting permission to output a character through the UART.

An application program need not employ any of OS/2's automatic handshaking modes, of course; it can perform its own handshaking instead. DTR and RTS can be manipulated manually with the SETMODEMCTRL function, and CTS, DSR, RI (Ring Indicator), and DCD are read by DosDevIOCtl's GETMODEMINPUT function. It is important to note, however, that if the application program gives up

Under OS/2, all interaction between an application program and the serial port is routed through the operating system and, in turn, through OS/2's serial device driver. The DosDevIOCtl function is used to set the device driver's operating parameters. Standard API functions, such as DosRead and DosWrite, are used to transfer characters between the device driver's internal transmit and receive queues and the application's data space.

The serial device driver is bimodal and fully interrupt-driven, ensuring optimum performance from OS/2's serial I/O subsystem.

Figure 4: Compare this programming model to the one in the previous issue, and you will see the essential difference between DOS and OS/2 communications programming. Under OS/2, the application is relieved of its device management tasks, which are performed by the driver.

control of DTR or RTS (by setting either to input handshaking mode or by telling RTS to toggle-on-transmit mode), the corresponding pin cannot be changed by SETMODEMCTRL. To make such a change, the program must first cancel automatic handshaking. It can do this in one of two ways: either by clearing the lower two bits of bFlags1 (to disable DTR) or the upper two bits of bFlags2 (to disable RTS), or by setting the higher of the two bits while clearing the lower of the two. This will enable the corresponding pin and will free it from the device driver's control.

OS2TERM

Figure 4 shows a conceptual model for a typical OS/2 communications program. OS2TERM.C, shown in Figure 5, is the source listing for a protected-mode terminal-emulation program based on the model. C has quickly become the language of choice for OS/2 developers. And the OS/2 API is specially tailored to the C programming language by virtue of its stack-based argument-passing protocol. If you have a copy of the Microsoft C Compiler, Version 5.1, and you have installed it with OS/2 support, you can compile and link OS2TERM yourself with the following command line:

```
cl -Lp -Zp -G2 os2term.c
```

While OS2TERM is functionally identical to the DOSTERM emulator presented in the previous issue, in terms of implementation they bear little resemblance. In OS2TERM, all interaction between the program and the serial port hardware is handled by the operating system. The interrupt service routines that serve the UART are coded into the COM0*x*.SYS device driver, and the driver in turn is accessed with standard OS/2 API calls. This single level of indirection incurs a small performance penalty (the overhead involved in routing everything through the operating system), but it pays great dividends in simplification. The program's only job becomes that of sending and receiving bytes; it neither knows nor cares how they're being sent and received.

OS2TERM begins by using OS/2's DosOpen function to open COM1 for reading and writing. To ensure that it has sole access rights to the port, the program opens COM1 in deny-read-write mode. DosDevIOCtl's SETBAUDRATE and SETLINECTRL functions are invoked to set the data rate to 9,600 bits per second and the line control characteristics to 8 data bits, 1 stop bit, and no parity. One argument passed to SETLINECTRL is the address of a structure whose fields define the desired line settings. This structure, called LineCtrl, is declared, and its variable values predefined, in the global data section of OS2TERM.C.

Once the data-rate and line-control settings are set, OS2TERM calls GETDCBINFO, passing the address of the DCBInfo structure as an argument. Using this address, GETDCBINFO fills in the fields of DCBInfo with the current parameter values. OS2TERM alters five fields: usWriteTimeout, usReadTimeout, bFlags1, bFlags2, and bFlags3. These changes effect 60-second timeouts, enable DTR and RTS, disable DSR input sensitivity, and initialize the driver for normal write processing and wait-for-something reads. A call to SETDCBINFO formalizes the new DCB settings.

With the COM0*x*.SYS now properly initialized, OS2TERM creates a separate thread of execution whose sole purpose is to read and display incoming characters. The ability to compartmentalize functions in their own threads and have the operating system manage the time slices allotted to them is one of the great advantages OS/2 provides to communications programmers. Since the primary thread will be monitoring the keyboard at the same time

OS2TERM.C 1 of 2

```
/*
 *        OS2TERM.C - An interrupt-driven OS/2 terminal emulator
 *
 *        This program uses OS/2's COM0x.SYS serial device
 *        driver to turn a PC into a simple terminal.  Incoming
 *        data is buffered in OS/2's 1,024-byte serial receive
 *        queue and transferred to the program's data space
 *        using wait-for-something reads.  DTR and RTS are asserted
 *        but no handshaking is performed with the RS-232 control
 *        pins.  Execution is terminated when ESC   is pressed.
 *
 *        Compile and link with:  cl -Lp -G2 -Zp os2term.c
 *
 *        Copyright (c) 1989 Ziff Communications Co.
 *        PC Magazine * Jeff Prosise, September 26, 1989
 */

#define INCL_DOS
#define INCL_SUB
#define INCL_DOSDEVICES

#define SERIAL 0x01
#define SETBAUDRATE 0x41
#define SETLINECTRL 0x42
#define SETDCBINFO 0x53
#define GETDCBINFO 0x73

#define STACK_SIZE 2048
#define BPS 9600
#define KBD_HANDLE 0
#define VIO_HANDLE 0

#include <os2.h>
#include <stdio.h>

struct {
          unsigned char DataBits;
          unsigned char Parity;
          unsigned char StopBits;
} LineCtrl = {       8,                    // 8 data bits
                     0,                    // No parity
                     0  };                 // 1 stop bit

struct {
          unsigned short usWriteTimeout;
          unsigned short usReadTimeout;
          unsigned char bFlags1;
          unsigned char bFlags2;
          unsigned char bFlags3;
          unsigned char bErrorReplacementChar;
          unsigned char bBreakReplacementChar;
          unsigned char bXONChar;
          unsigned char bXOFFChar;
```

Figure 5: The C source code listing for OS2TERM, a protected-mode terminal-emulation program, emphasizes the differences between the DOS and OS/2 communication programming environments. The DOS equivalent of OS2TERM was presented in the previous issue.

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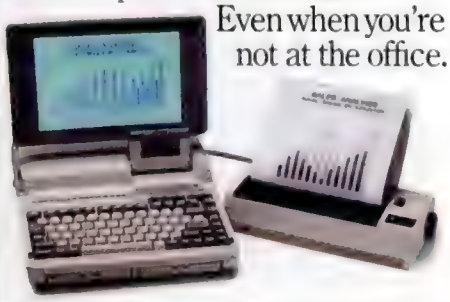

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OS2TERM.C 2 of 2

```
} DCBInfo;

unsigned short hCom;            // COM handle
unsigned char InBuffer[256];    // Input buffer

/*
 *      The primary thread opens and initializes the COM
 *      driver, starts a thread to monitor the serial port,
 *      displays and outputs characters typed at the keyboard,
 *      and terminates when ESC is pressed.
 */

main()
{
        unsigned short usAction;
        unsigned short usBaudRate = BPS;
        unsigned ThreadID;
        static char ComThdStk[STACK_SIZE];
        struct _KBDKEYINFO KbdData;
        unsigned short usBytesWritten;

        void far ComThread();

        /* Open and initialize COM1 */

        if (DosOpen("COM1", &hCom, &usAction, 0L, 0, 1, 0x12, 0L)) \
             printf("COM1 not available or COM0x.SYS not loaded\n");
             exit(1);
        }

        /* Set data rate to 9600 bps and line format to N81 */

        DosDevIOCtl(0L, &usBaudRate, SETBAUDRATE, SERIAL, hCom);
        DosDevIOCtl(0L, &LineCtrl, SETLINECTRL, SERIAL, hCom);
        /* Set Device Control Block parameters */

        DosDevIOCtl(&DCBInfo, 0L, GETDCBINFO, SERIAL, hCom);

        DCBInfo.usWriteTimeout = 6000; // 60 second write timeout
        DCBInfo.usReadTimeout = 6000;  // 60 second read timeout
        DCBInfo.bFlags1 = 0x01;        // Enable DTR
        DCBInfo.bFlags2 = 0x40;        // Enable RTS
        DCBInfo.bFlags3 = 0x04;        // Wait-for-something reads

        DosDevIOCtl(0L, &DCBInfo, SETDCBINFO, SERIAL, hCom);

        /* Create a thread to monitor the serial port */

        DosCreateThread(ComThread, &ThreadID, ComThdStk+STACK_SIZE);

        /* Monitor the keyboard and output typed characters */

        do {
             KbdCharIn(&KbdData, IO_WAIT, KBD_HANDLE);

             if ((KbdData.chChar != 0) && (KbdData.chChar != 0x1B)) {
                 VioWrtTTy(&KbdData.chChar, 1, VIO_HANDLE);
                 DosWrite(hCom, &KbdData.chChar, 1, &usBytesWritten);
             }

        } while (KbdData.chChar != 0x1B);

        DosExit(EXIT_PROCESS, 0);
}

#pragma check_stack (off) // Disable stack checking

/*
 *      This thread monitors COM1 for incoming bytes and writes
 *      any it receives to the display screen.  If an error is
 *      returned by DosRead(), the thread terminates itself.
 */

void far ComThread()
{
        unsigned short usBytesRead;

        while (!DosRead(hCom, InBuffer, 256, &usBytesRead))
             if (usBytesRead)
                 VioWrtTTy(InBuffer, usBytesRead, VIO_HANDLE);

        DosExit(EXIT_THREAD, 1);
}
```

the new thread monitors the serial port, it doesn't matter that OS2TERM uses large timeout values. That's because the keyboard thread will still get time slices even while a DosRead executes, so that we can terminate the program with a keystroke regardless of the status of the other thread.

After the new thread is dispatched, the primary thread falls into a simple loop that reads the keyboard and outputs any characters it receives to the display and to the serial port. When the Esc key is pressed, the thread executes a DosExit call to end the process.

Like DOSTERM, OS2TERM is completely independent of the RS-232 control pins. This isn't quite typical of communications programs, but I had a reason for making it so—it ensures that both programs will function properly no matter how the null modem cable linking them is wired. As long as DOSTERM and OS2TERM are used with a cable whose TD (Transmit Data) and RD (Receive Data) pins are crossed, the programs should work flawlessly.

MULTITHREADED PROGRAMMING

OS2TERM provides a simple application of multithreaded programming techniques, in which one thread is dispatched to handle incoming data while the other manages outgoing information. Multithreaded programming is a powerful technique that has implications far beyond its simple application here.

To begin with, multiple threads eliminate the code serialization required of single-tasking application programs. DOSTERM, for example, had to alternately poll the keyboard and the serial input queue (a queue it set up and maintained) for data. Characters had to be processed on a first-come, first-served basis. In OS/2, you simply assign each task its own thread of execution and let the operating system take care of time multiplexing.

Actually, OS2TERM is simple enough that it doesn't absolutely *have* to use two different threads, though this approach certainly makes the code cleaner. Other applications, however, may not be as simple. Your communications program, for example, might support a large-packet file-transfer protocol whose packet size exceeds 1,024 bytes. When the packet size is smaller than the buffer size, there is no danger of overrunning the receive queue; the transmitting device won't send another packet until you've checked and acknowledged the last one. But with oversize

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packets comes the possibility that the buffer will overflow while your program checks the contents of the last packet transmitted.

Multithreaded programming provides the solution: just create a thread whose only duty is to read characters from the serial port and rebuffer them in your own internally maintained receive buffer. You can size this buffer to fit any specification, leaving the primary program thread free to attend to other duties while the background thread continues processing incoming data.

This solution, of course, is exactly analogous to the way DOSTERM manages its own receive buffer—though under OS/2 such a measure is necessary only in the most extreme cases. Still, I am left with the hope that a future version of OS/2 will make the sizes of the serial device driver's transmit-and-receive queues an option configurable under program control.

In the meantime, however, OS/2 gives you another way to sidestep potential buffer-overflow problems. By setting up a pipe with DosMakePipe, a program can let OS/2 take care of the additional layer of buffering. You could have the thread that reads the serial port simply stuff incoming characters into the pipe with DosWrite and have the primary thread extract data from the other end with DosRead. With DosMakePipe, you can make the pipe any size you want up to 64K. (At least one commercial OS/2 communications program I know of uses this general idea to circumvent OS/2's limited queue size, although its authors chose to forego pipes per se and implemented their own queuing logic in order to achieve the best performance possible.)

A third solution would be to jack up the priority of the thread that reads characters from the device driver's receive buffer from *regular* to *time-critical*. I don't recommend this approach, however, as it has been my experience that running time-critical threads is asking for trouble. (While experimenting with time-critical threads in OS2TERM, I found that other portions of the program were quite often starved for CPU time, resulting in poor performance and even, in some cases, lockups.) So investigate other alternatives first; if all else fails, turn to adjusting thread priorities. But be prepared for a long beta-test cycle to ferret out sources of program failures and anomalous program behavior.

THE OS/2 ALTERNATIVE

The raw number of options OS/2 provides with its serial device driver may seem intimidating, but with that complexity comes power. Once you've mastered DosDevIOCtl and its serial device functions, building a communications program around COM0*x*.SYS becomes a simple task. The clincher is that, thanks to OS/2's willingness to do the dirty work, it doesn't take a single extra line of code to endow OS2TERM with some really advanced capabilities—flow control, handshaking, etc. Contrast that with the code that makes up DOSTERM, and you'll begin to appreciate the power of OS/2. ■

Jeff Prosise is a contributing editor of PC Magazine.

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CIRCLE 103 ON READER SERVICE CARD

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by Douglas Boling
and Jeff Prosise

Utilities

Control the Brightness of Your VGA Screen

If the EGA made color displays palatable, the VGA makes them worth savoring. Introduced with IBM's PS/2 line, the VGA became an instant industry standard and is now available from many manufacturers for all makes of personal computer. With a 640- by 480-pixel density, a 1:1 aspect ratio in high-resolution graphics, and an ability to display up to 256 colors from a palette of over 256,000, the VGA provides sufficient screen and color resolution for all but the most demanding application programs.

Even this list does not exhaust the virtues of the VGA, however. Its flexible (if complex) architecture is a superset of the earlier EGA, and provides vastly enhanced programming capabilities. DIMMER, the utility introduced here, takes advantage of one of the VGA's special architectural features to bring the brightness of the display under software control. While the screen intensity in most video systems is controlled solely by the knobs on the monitor, a special set of *color registers* in the VGA makes it possible to fade individual colors in and out independently of the monitor settings.

SOFTWARE CONTROL

DIMMER is a RAM-resident (TSR) utility that lets you adjust the brightness of your VGA display to compensate for varying ambient light levels in the room. You can control the program's operation either from the keyboard or through command-line parameters. Additionally, if it's desired, DIMMER will automatically adjust (or completely blank) the display when a specified interval passes without keyboard activity.

You can get a ready-to-run copy of the DIMMER program simply by downloading it from PC MagNet, as explained in the sidebar "DIMMER by Modem." DIMMER.ASM, the assembly language source code, is printed here, as is DIMMER.BAS, a BASIC program that will automatically produce the .COM file when you run it. Both of these listings are also available on PC MagNet.

■ Light levels change—in a room and from room to room. DIMMER lets you adjust the brightness of your VGA to an intensity suitable to your surroundings.

The full syntax for DIMMER is

```
DIMMER [[+|-]adj] [/D time [+|-
]adj] [/V[+|-]] [/U]
```

When first installed, with or without any of its optional command-line parameters and switches, DIMMER records the current intensity level of the VGA display. This value becomes its default or "home-base" reference point. Three key combinations then permit you to control monitor brightness at any time, even while an application program is running. Pressing Alt–Up Arrow increases the intensity; Alt–Down Arrow decreases it. Repeatedly pressing Alt–Up Arrow will wash most colors out, and hitting the Alt–Down Arrow key enough times will completely blank the display. Whatever changes you make in this way, however, hitting Alt-Home will always get you back to the home-base value from which you started.

The command-line *adj* variable is a positive or negative integer between +63 and −63, inclusive. When specified, this value determines the amount by which to raise or lower the brightness. If you enter `DIMMER -10`, for example, the intensity levels of each of the three color guns used to paint the display will be lowered 10 notches. Note that *adj* values are always relative to the initial, not to the current display state. Entering `DIMMER -10` a second time will produce no further effect, since the intensity is already 10 levels below the home-base state. To dim the screen another 10 levels, you would enter `DIMMER -20`. Entering `DIMMER 0` is equivalent to pressing the Alt-Home key combination and will restore the screen to the default brightness level.

Including a /D switch, a *time* value, and an *adj* value on the command line activates DIMMER's VGA screen-saver feature. The *time* value sets the number of minutes DIMMER will wait after the last keystroke before automatically adjusting the intensity by the amount specified. Legal *time* values range up to 65,534 minutes, which is over 1,000 hours, or 45 days. If you enter `DIMMER /D 5 -20`, for example, DIMMER will lower the display intensity 20 notches when 5 minutes have passed without a key being pressed.

If you install DIMMER with the screen saver active and change your mind about the *time* or *adj* values you have entered, simply run it again with new *time* and *adj* values. The new parameters will take effect immediately, and the program will not reduplicate itself in memory. Alternatively, you can deactivate the screen saver altogether by entering `DIMMER /D 0`.

Specifying an *adj* value of −63 blanks the display entirely, temporarily hiding the

data displayed on it and protecting the monitor from burn-in. Burn-in occurs if an image left on the screen for an extended period of time at high intensity becomes permanently ingrained in the monitor's high-persistence phosphors. Although color monitors aren't nearly as susceptible to this phenomenon as monochrome monitors are, there's no need to leave any monitor running unattended. DIMMER extends the same sort of protection to VGA systems that other utilities do to systems equipped with monochrome adapters, CGAs, and EGAs.

Once the screen is blanked (or simply dimmed), any keypress will restore it, and the countdown will begin anew. The keystroke you enter will register in the currently running application program, however, so be sure to pick a key that won't harm your data. If you're not sure, just press a control key that's harmless under normal circumstances: Ctrl, Alt, or one of the Shift keys.

There are occasions on which you may want a blanked screen restored when the running program updates the screen. This can be accomplished by installing DIMMER with a /V or /V+ parameter. When this optional video sensitivity switch is included, DIMMER will respond if the program calls a video BIOS routine to write information to the screen. The effect is the same as pressing a keystroke manually. But be warned that the video-sensitivity switch can be fooled. Many application programs write directly to the video buffer, bypassing the video BIOS. DIMMER has no way to trap direct video buffer accesses. By default, DIMMER restores the screen only when a keystroke is typed. This is the equivalent of running DIMMER with a /V- command-line switch.

As is customary in *PC Magazine* utilities, entering the command name with the /U parameter will uninstall a resident copy of DIMMER.

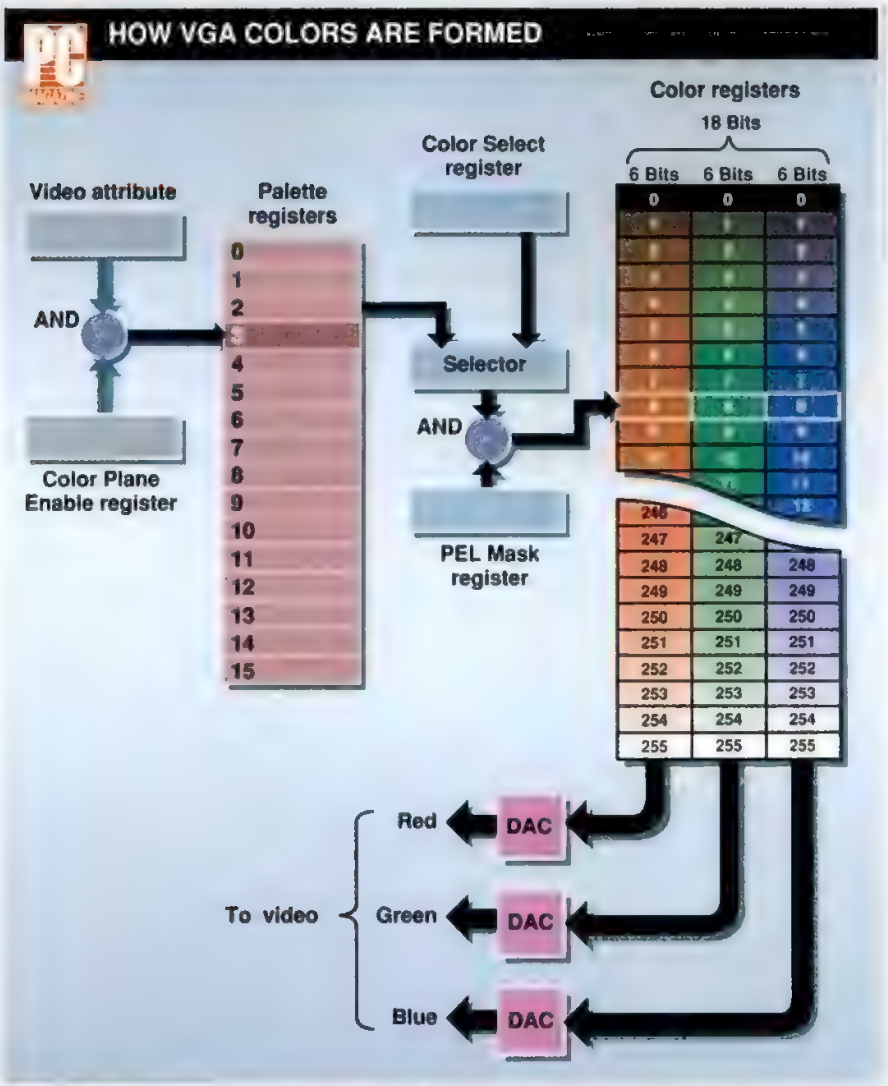

Figure 1: The VGA's 18-bit color registers allocate 6 bits (64 possible intensity levels) for each of the three primary colors. A total of 262,144 colors can be formed. As detailed in the text, however, an indirect color-formation process is used to maintain compatibility with EGA and CGA programs.

VGA ARCHITECTURE

A dip into the VGA *Technical Reference* manual shows how complex the VGA really is. It has no less than five major subcomponents: the CRT Controller, the Sequencer, the Graphics Controller, the Attribute Controller, and the Digital-to-Analog Converter (DAC). And its more than 300 internal registers provide a programming flexibility far exceeding that of any previous IBM display adapter—including that of the EGA.

Unlike the EGA, which generates discrete, digital (TTL level) signals, the VGA generates analog output signals. In an analog output system, intensity information for each of the three color guns is encoded in variable rather than in fixed-level signal amplitudes. As a result, the VGA can display a far wider range of colors than can digital video cards. The color signals sent to the analog display device are generated by the Attribute Controller. In the VGA, the attribute bytes stored in video memory travel a circuitous path before they become colors on the display screen.

The VGA's attribute-control logic is shown schematically in Figure 1. In 16-color modes (such as the color text modes), a 4-bit video attribute value stored in display memory is logically ANDed with bits 0 to 3 of the Color Plane Enable register, and the resulting value is used to index one of the VGA's 16 palette registers. Bits in the palette registers are in turn combined with bits in the Color Select register and ANDed with the PEL Mask register to form the 8-bit address of one of the 256 VGA color registers. The color registers are 18-bits wide—6 bits for each of the three primary colors: red, green, and blue. This provides 64 intensity levels for each primary color and a total of 262,144 different color combinations from which to choose.

Exactly how bits from the palette registers are combined with bits in the Color Select register to form 8-bit color register addresses is determined by the state of bit 7 in

the Attribute Controller's Mode Control register. When bit 7 is set to 0, an 8-bit value is generated from bits 2 and 3 of the Color Select register and the lower 6 bits of the palette register. When bit 7 is set to 1, bits 0 through 3 of the Color Select register are combined with the lower 4 bits of the palette register. In both cases, the bits extracted from the Color Select register become the uppermost bits of the derived 8-bit address.

Using the first combination scheme (bit 7 = 0), the Color Select register acts as the switch between four banks of color registers comprising 64 registers each. In the second system (bit 7 = 1), the Color Select register acts as an index into 16 banks of 16 color registers each. By programming the Color Select and Mode Control registers accordingly, an application program can set up a number of different palettes within the limits of the 256-color register set. Then, by simply modifying a register, the program can switch between them, achieving almost instantaneous color changes.

This multilevel indirect system, in which the palette registers are used to address color registers rather than to define colors directly, is one of the features that distinguishes the VGA from the EGA. In the EGA, intensity levels for each of the three color guns are derived directly from the 6-bit EGA palette registers. This provides a palette of only 64 colors, from which any 16 are selectable at a time.

By incorporating the same array of palette registers, however, the designers of the VGA ensured that programs written for the EGA will run on the VGA without modification. EGA programs running on the VGA aren't even aware of the presence of the 256 color registers. In the same way, CGA programs running on the EGA aren't aware that 4-bit color attribute values don't represent color values at all, but are funneled through the EGA palette registers before being converted into TTL output signals.

HOW DIMMER WORKS

The key to DIMMER's operation is found in the VGA's array of 18-bit color registers. Using 6 bits for each of the three color guns means that each color can be assigned an intensity level from 0 to 63. By contrast, the EGA's 6-bit palette registers (roughly the equivalent of the VGA color registers) provide only 2 bits per gun, yielding four different intensity levels for each color. The VGA's ability to provide finer discrimination among color levels invites software control to adjust the intensity settings to a user's liking.

The 256 color registers are accessed through the VGA's PEL Address and Data registers. The PEL Address Write register is mapped to I/O address 3C8h, while the PEL Address Read register is mapped to 3C7h. To set the value of one of the color registers, a program first OUTs the register number (from 0 to 255) to port 3C8h. The program then outputs three consecutive byte values—corresponding to the desired red, green, and blue values, in that order—to 3C9h. Similarly, to read the contents of a color register, a program OUTs the address to 3C7h, then reads three byte values from 3C9h. When byte values are written to the color registers, only the lower 6 bits of the 8-bit value are used. Proper programming practice dictates that the upper 2 bits be zeroed, just to make sure the results are predictable.

Once an address is output to either of the PEL Address registers, the VGA hardware automatically increments the address by 1 with each read or write in anticipation of the *next* read or write. Therefore, a program need only output a color register address of 0 once and execute 768 (256 times 3) INs or OUTs in sequence to access all 256 color registers. Interrupts should be disabled while a block of color registers is written or read. The routines ADJ_PALETTE_1 and GET_PALETTE in the DIMMER.ASM source code listing illustrate how this is done.

At installation, DIMMER reads the RGB values of all 256 color registers from the VGA and buffers them in memory. If you press the Alt–Down Arrow key combination, DIMMER decrements a variable called *dimmer_val* (whose initial value is 0) by 1, adds the new *dimmer_val* to each buffered color-register value, and writes the modified values back to the color registers. The effect is to dim the display screen slightly.

Decrementing the intensity values 63 times will effectively snuff out all colors, even those that initially contained the maximum allowable intensities for any of the three colors. (Note: to prevent colors from wrapping around, DIMMER will not decrement below 0.) Likewise, pressing Alt–Up Arrow increments the value of each color register by 1, and Alt-Home restores all registers to their original values—the values that were read and stored when DIMMER was installed.

Alt–Up Arrow increments only the nonzero RGB components of the color registers. This prevents blacks from being transformed into whites as the intensity of all three color guns is increased. It also prevents colors composed of only one or two of the three primary colors from being diluted. As a result, DIMMER can as easily *brighten* the display as dim it, a useful feature in overlit office environments.

To illustrate how DIMMER works, let's first take a look at what happens to a single color register when Alt–Down Arrow is pressed. On color IBM video adapters, the attribute value 3 is the default value for the color cyan, which is composed from an equal mixture of blue and green with no red. At power-up on the VGA, palette register 3 addresses color register 3, which in turn holds the values 00h, 2Ah, and 2Ah for the R, G, and B color guns, respectively.

Subtracting 1 from each color value yields 00h, 29h, and 29h. (Note: to keep colors from recycling, DIMMER won't adjust any intensity level to less than 0 or greater than 63). The three newly calculated values are written back to color register 3, and the intensity of color number 3 displayed anywhere on the screen is then correspondingly reduced. Another press of Alt–Down Arrow reduces the intensity yet another level, and so on, until all three color guns reach 0.

Had Alt–Up Arrow been pressed instead, only the B and G color components would have been incremented, since the R component was initially 0. Cyan contains no reds; adding reds by incrementing the zero R value would change not just the intensity of the color, but the color itself.

At installation, DIMMER hooks into system interrupts 08h, 09h, and 10h. Interrupt 08h is the timer interrupt, which is generated 1,092 times per minute and is used by DIMMER in its screen-saver mode to time periods of keyboard inactivity. By intercepting interrupt 09h, DIMMER can detect when Alt–Down Arrow, Alt–Up Arrow, and Alt-Home—key combinations not normally supported by the keyboard BIOS—are pressed.

Interrupt 10h, which provides access to the BIOS video services, is monitored for several reasons. If DIMMER's screen saver feature is active and video sensitivity is enabled, DIMMER must restore the display whenever a program calls an interrupt

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DIMMER.ASM 1 of 5

```
                page    66,132
;=============================================================================
; DIMMER.COM allows VGA users to interactively brighten or dim the screen.
; Syntax is:
;
;       DIMMER [/U] [/V[+|-]] [/D mmm [+|-]xx] [[+|-]xx]
;
; where /U = Uninstall the program
;       /D = Adjust intensity by xx after mmm minutes of inactivity
;       xx = Numeric code from -63 to +63 representing relative
;            amount by which to adjust the intensity
;       /V = Reset delay timer on call to BIOS video interrupt. The
;            default is V-.
;
; COMMAND LINE INTENSITY CONTROL
;
;       DIMMER /D 1 -63 causes the screen to blank after 1 minute of
;       inactivity.  DIMMER /D 0 cancels any time delay previously entered.
;       DIMMER -20 causes the screen to immediately dim 20 intensity levels.
;       DIMMER 0 restores the screen intensity to what it was when DIMMER
;       was installed.  In all cases, DIMMER becomes RAM-resident so that
;       intensity levels can also be adjusted interactively.
;       DIMMER /D 1 -63 /V causes the screen to blank after 1 minute of
;       inactivity.  If a program calls any BIOS video routines, the
;       screen is reset to its original brightness.
;
; INTERACTIVE INTENSITY CONTROL
;
;       With DIMMER installed, Alt-UpArrow increases the display intensity
;       by 1 level, Alt-DnArrow decreases the intensity by 1 level, and
;       Alt-Home restores the screen intensity to what it was when DIMMER
;       was installed.
;=============================================================================

code    segment
        assume  cs:code

        org     2ch
env_segment     dw      ?                       ;Address of environment block
        org     80h
command_tail    dw      ?                       ;Address of command tail

        org     100h
main:   jmp     initialize              ;Go to initialization code

program         db      "Dimmer 1.0 "
copyright       db      "(c) 1989 Ziff Communications Co.",13,10
authors         db      "PC Magazine ",254," Doug Boling and Jeff Prosise"
                db      "$",1Ah

dimmer_val      db      0                       ;Relative dimmer value
delaydimval     db      0                       ;Delayed dimmer value
wait_time       dw      -1                      ;Delay until screen blank
dim_counter     dw      -1                      ;Number of minutes to delay
second_cnt      dw      1092                    ;Timer ticks per minute
restorebyvid    db      0                       ;1 = delay reset by video call
vid_function    dw      0                       ;Saved video function
int08h          dd      ?                       ;Int 8 vector (Timer)
int09h          dd      ?                       ;Int 9 vector (Keyboard)
int10h          dd      ?                       ;Int 10 vector (Video)

;=============================================================================
; TIMERINT services the BIOS timer interrupt.
;=============================================================================
timerint        proc    far
                pushf                           ;Push flags
                call    int08h                  ;Call BIOS timer routine
                sti                             ;Enable interrupts

                push    ax                      ;Save AX
                mov     ax,cs:[dim_counter]     ;Get delay counter
                cmp     ax,0FFFFh               ;See if timer enabled
                je      timer_exit              ;Exit if not enabled
                or      ax,ax                   ;Exit if timer at 0 to
                je      timer_exit              ;  prevent rollover.

                dec     cs:[second_cnt]         ;Decrement seconds and exit
                jnz     timer_exit              ;  if not zero
                mov     word ptr cs:[second_cnt],1092
                dec     ax                      ;Decrement minute counter
                mov     cs:[dim_counter],ax     ;Update delay counter
                or      ax,ax                   ;Exit if timer hasn't
                jne     timer_exit              ;  reached zero

                mov     ah,cs:[delaydimval]     ;Get dimmer value
                call    adj_palette_2           ;Modify color registers
timer_exit:
                pop     ax                      ;Restore AX and exit
                iret
timerint        endp

;=============================================================================
; KBINT services the keyboard interrupt.
;=============================================================================
kbint           proc    far
                sti                             ;Enable interrupts
                push    ax                      ;Save AX
                mov     cs:[second_cnt],1092    ;Reset delay counters
                mov     ax,cs:[wait_time]
                mov     cs:[dim_counter],ax
                or      ax,ax                   ;If counter was 0, reset the
                jne     kbint0                  ;  screen intensity

                mov     ah,cs:[dimmer_val]
                call    adj_palette_2
kbint0:
                push    ds                      ;Save DS
                mov     ax,40h                  ;Point DS to BIOS data area
                mov     ds,ax
                mov     al,ds:[17h]             ;Get keyboard shift status
                pop     ds                      ;Restore DS
                and     al,0Fh                  ;Mask upper 4 bits
                cmp     al,8                    ;Check for Alt key
                je      alt_found               ;Continue if Alt is pressed
goto_bios:
                pop     ax                      ;Restore AX and exit to
                jmp     int09h                  ;  BIOS keyboard handler
alt_found:
                in      al,60h                  ;Get key pressed
                cmp     al,72                   ;Check for UpArrow
                jne     kbint1
                cmp     cs:[dimmer_val],63      ;Increment color registers
                jge     kbint3                  ;  by 1 if dimmer value
                inc     cs:[dimmer_val]         ;  isn't maxed out
                jmp     short kbint3
kbint1:
                cmp     al,80                   ;Check for DnArrow
                jne     kbint2
                dec     cs:[dimmer_val],-63     ;Decrement color registers
                jle     kbint3                  ;  by 1 if dimmer value
                mov     cs:[dimmer_val]         ;  isn't zeroed out
                jmp     short kbint3
kbint2:
                cmp     al,71                   ;Reset color registers if
                jne     goto_bios               ;  Alt-Home was pressed
                mov     cs:[dimmer_val],0
kbint3:
                mov     ah,cs:[dimmer_val]      ;Get dimmer value
                call    adj_palette_2           ;Modify color registers

                cli                             ;Disable interrupts
                in      al,61h                  ;Reset the keyboard
                mov     ah,al                   ;  controller
                or      al,80h
                out     61h,al
                mov     al,ah
                out     61h,al

                mov     al,20h                  ;Signal end-of-interrupt to
                out     20h,al                  ;  the interrupt controller
                sti                             ;Enable interrupts

                pop     ax                      ;Restore AX and exit
                iret
kbint           endp

;=============================================================================
; VIDEOINT services the BIOS video interrupt.
;=============================================================================
videoint        proc    far
                mov     cs:[vid_function],ax    ;Save function number
                pushf                           ;Push flags
                call    int10h                  ;Call video BIOS routine
                sti                             ;Enable interrupts
                push    ax                      ;Save AX

                cmp     cs:[restorebyvid],0     ;If video checking enabled,
                je      video_1                 ;  check delay counter.
                cmp     word ptr cs:[dim_counter],0
                jne     video_1                 ;Restore color register
                mov     ah,cs:[dimmer_val]      ;  values if timed delay
                call    adj_palette_2           ;  has dimmed the screen
                mov     cs:[second_cnt],1092    ;Reset delay counters
                mov     ax,cs:[wait_time]
                mov     cs:[dim_counter],ax

video_1:
                mov     ax,cs:[vid_function]    ;See what function was called
                or      ah,ah                   ;Check for mode change
                je      refresh_palette
                cmp     ah,11h                  ;Check for mode reset
                je      refresh_palette

                cmp     ax,1018h                ;Check for changes to the
                je      refresh_buffer          ;  VGA color registers
                cmp     ax,1012h                ;  made thru the video
                je      refresh_buffer          ;  BIOS
                cmp     ax,1019h
                jne     video_exit
refresh_buffer:
                call    get_palette             ;Reload register array
                jmp     short video_exit

refresh_palette:
                mov     ah,cs:[dimmer_val]      ;Get dimmer adjust value
                call    adj_palette_2           ;Modify palette
video_exit:
                pop     ax                      ;Restore AX and exit
                iret
videoint        endp

;-----------------------------------------------------------------------------
; ADJ_PALETTE_1 adjusts the VGA color registers to their original values
; plus the current dimmer value.
;   Entry:  AH = Dimmer value
;           DS = Segment where color register values are stored
;-----------------------------------------------------------------------------
adj_palette_1   proc    near
                cld                             ;Clear direction flag
```

DIMMER.ASM: The assembly language source code for DIMMER.COM, which controls VGA brightness levels through software.

DIMMER.ASM 2 of 5

```
                push    cx                      ;Save registers
                push    dx
                push    si

                mov     si,offset end_res       ;Point SI to buffer
                                                ;  containing original values
                mov     dx,03C8h                ;Write address register
                xor     al,al                   ;Set beginning address
                cli                             ;Disable interrupts
                out     dx,al
                mov     cx,256 * 3              ;256 color registers
                mov     dx,03C9h                ;Write data register
adj_loop1:
                lodsb                           ;Get color value
                call    mod64_add               ;Add dimmer value
                out     dx,al                   ;Write data to color register
                loop    adj_loop1               ;Loop until done

                sti                             ;Enable interrupts
                pop     si                      ;Restore registers and exit
                pop     dx
                pop     cx
                ret
adj_palette_1   endp

;---------------------------------------------------------------------------
; ADJ_PALETTE_2 adjusts the VGA color registers to their original values
; plus the current dimmer value.
;   Entry:  AH = Dimmer value
;---------------------------------------------------------------------------
adj_palette_2   proc    near
                push    ds                      ;Save DS
                push    cs                      ;Point DS to code segment
                pop     ds
                call    adj_palette_1           ;Modify color registers
                pop     ds                      ;Restore DS and exit
                ret
adj_palette_2   endp

;---------------------------------------------------------------------------
; MOD64_ADD adds AH to AL using modulo 64 math.
;---------------------------------------------------------------------------
mod64_add       proc    near
                or      al,al                   ;If 0, don't brighten
                je      mod2
                add     al,ah
                cmp     al,0                    ;See if underflow
                jg      mod1
                mov     al,0                    ;If so, set at minimum
                jmp     short mod2
mod1:
                cmp     al,63                   ;See if overflow
                jbe     mod2
                mov     al,63                   ;If so, set at maximum
mod2:
                ret
mod64_add       endp

;---------------------------------------------------------------------------
; GET_PALETTE buffers the current values of the VGA color registers.
;---------------------------------------------------------------------------
get_palette     proc    near
                cld                             ;Clear direction flag
                push    ax                      ;Save registers
                push    cx
                push    dx
                push    di
                push    es

                mov     cx,cs                   ;Point ES to the code segment
                mov     es,cx
                mov     di,offset end_res       ;Point DI to save buffer
                mov     dx,03C7h                ;Read address register
                xor     al,al                   ;Begin with register 0
                cli                             ;Disable interrupts
                out     dx,al
                mov     cx,256 * 3              ;256 color registers
                mov     dx,03C9h                ;Read data register
getp_loop1:
                in      al,dx                   ;Get color register value
                and     al,3Fh                  ;Mask off the upper 2 bits
                stosb                           ;Store it
                loop    getp_loop1              ;Loop until done

                sti                             ;Enable interrupts
                pop     es                      ;Restore registers and exit
                pop     di
                pop     dx
                pop     cx
                pop     ax
                ret
get_palette     endp
;---------------------------------------------------------------------------
; FINAL_INSTALL is the last of the resident code.
;---------------------------------------------------------------------------
final_install:
                assume  ds:code
                call    get_palette             ;Get color register values
                mov     ah,dimmer_val           ;Adjust color registers and
                call    adj_palette_2           ;  terminate
                mov     dx,(offset end_res-offset code+768+15) SHR 4
                mov     ax,3100h
                int     21h
end_res         =       $                       ;End of resident code

;===========================================================================
; Start of non-resident section.
;===========================================================================

alrdy_installed db      0                       ;Installed flag
other_seg       dw      0                       ;Segment of installed code
change_flag     db      0                       ;Set if dimmer or delay
                                                ;  value is modified
infomsg1        db      "Program uninstalled$"
errmsg1         db      "Program not installed$"
errmsg2         db      "Syntax: DIMMER [/U] [/V[+|-]] [/D nnn [+|-]xx]"
                db      "  [[+|-]xx]$"
errmsg3         db      "Can",39,"t uninstall$"
errmsg4         db      "VGA required$"
errmsg5         db      "Intensity value must be between -63 and +63$"
errmsg6         db      "Invalid delay value$"
errmsg7         db      "Program already installed$"
errmsg8         db      "Invalid intensity value$"

initialize      proc    near
                assume  cs:code,ds:code
;
;See if a copy of DIMMER is already resident in memory.
;
                cld                             ;Clear direction flag
                mov     word ptr [main],0       ;Initialize fingerprint
                xor     bx,bx                   ;Zero BX for start
                mov     ax,cs                   ;Keep CS value in AX
find_copy:
                inc     bx                      ;Increment search segment
                mov     es,bx
                cmp     ax,bx                   ;Not installed if current
                je      find_copy1              ;  segment is found
                mov     si,offset main          ;Search this segment for ASCII
                mov     di,si                   ;  fingerprint.
                mov     cx,16
                repe    cmpsb
                jne     find_copy               ;Loop back if not found
                inc     alrdy_installed         ;Set installed flag
find_copy1:
                mov     other_seg,es            ;Save segment value
;
;Verify that a VGA is installed.
;
                mov     ax,1A00h                ;BIOS read display function
                int     10h
                mov     dx,offset errmsg4
                cmp     al,1Ah                  ;See if VGA present
                jne     disp_error              ;Exit on error if no VGA
;
;Parse the command line for switches.
;
                mov     si,offset command_tail+1        ;Point SI to command
parse_line_loop:                                        ;  tail in PSP
                lodsb                           ;Scan command line for / or a
                cmp     al,32                   ;  number.  Continue scanning
                je      parse_line_loop         ;  until a carriage return is
                cmp     al,13                   ;  found.
                je      parse_line_end

                cmp     al,"/"                  ;Is this a / character?
                jne     check_numeric           ;No, then check for numeric
                lodsb                           ;Get next character
                or      al,20h                  ;Convert to lower case
                cmp     al,"u"                  ;Check for uninstall switch
                je      uninstall_found
                cmp     al,"d"                  ;Check for delay switch
                je      delay_found
                cmp     al,"v"                  ;Check for reset delay by
                je      vidflag_found           ;  video call switch.
parse_line_error:
                mov     dx,offset errmsg2       ;Syntax error
                jmp     short disp_error        ;Display message and exit
;
;Read the dimmer value from the command line if entry is numeric.
;
check_numeric:
                cmp     al,"-"                  ;Convert ASCII number into
                je      numeric_start           ;  binary.  Check for leading
                cmp     al,"+"                  ;  sign.
                je      numeric_start
                cmp     al,"0"
                jb      parse_line_error
                cmp     al,"9"
                ja      parse_line_error
                dec     si
numeric_start:
                or      change_flag,1           ;Set bit 0 in change flag
                call    setdim                  ;Read and set dimmer value
                jmp     short chk_err_and_loop  ;Check for error return
;
;Read the time delay and dimmer values from the command line.
;
vidflag_found:
                call    setvidflag              ;Modify the state of video flg
                jmp     short chk_err_and_loop  ;Check for error return
delay_found:
                or      change_flag,2           ;Set bit 1 in change flag
                call    setdelay                ;Read and set delay value
chk_err_and_loop:
                jc      disp_error
                jmp     short parse_line_loop
;
;Uninstall the program from memory.
;
uninstall_found:
                mov     dx,offset errmsg1       ;Make sure program is
                cmp     alrdy_installed,0       ;  installed and signal
                je      disp_error              ;  error if it is not
                call    remove                  ;Remove program from memory
                mov     dx,offset errmsg3
                jc      disp_error              ;Error if can't remove
                mov     dx,offset infomsg1      ;Acknowledge if removed
                call    print_string
exit:
```

DIMMER.ASM 3 of 5

```
                mov     ax,4C00h                ;Exit with RC = 0
                int     21h
;
;Process new dimmer and/or delay values now if DIMMER is already resident.
;
parse_line_end:
                cmp     already_installed,0     ;Program already installed?
                je      install                 ;No, then install it
                cmp     change_flag,0           ;Changes to resident copy?
                jne     check_dimmer_change     ;Yes, then process them
                mov     dx,offset errmsg7
disp_error:
                call    print_string            ;No, then display error
                mov     ax,4C01h                ;  message and exit
                int     21h                     ;  with RC = 1
check_dimmer_change:
                test    change_flag,1           ;Adjust color registers if
                jz      check_delay_change      ;  dimmer value was changed
                push    ds
                mov     ds,other_seg            ;Point DS to installed
                assume  ds:nothing              ;  segment
                mov     ah,ds:[dimmer_val]
                call    adj_palette_1
                pop     ds
                assume  ds:code
                jmp     exit                    ;Terminate
check_delay_change:
                test    change_flag,2           ;Exit now if delay value
                jnz     exit                    ;  was modified
;
;Install a copy of DIMMER.
;
install:
                mov     ax,3508h                ;Hook into interrupt 8
                int     21h
                mov     word ptr int08h,bx
                mov     word ptr int08h[2],es
                mov     ax,2508h
                mov     dx,offset timerint
                int     21h

                mov     ax,3509h                ;Hook into interrupt 9
                int     21h
                mov     word ptr int09h,bx
                mov     word ptr int09h[2],es
                mov     ax,2509h
                mov     dx,offset kbint
                int     21h

                mov     ax,3510h                ;Hook into interrupt 10h
                int     21h
                mov     word ptr int10h,bx
                mov     word ptr int10h[2],es
                mov     ax,2510h
                mov     dx,offset videoint
                int     21h

                mov     dx,offset program       ;Display copyright notice
                call    print_string            ;  and jump to final
                jmp     final_install           ;  install code
initialize      endp

;-----------------------------------------------------------------------------
; PRINT_STRING displays a DOS "$"-delimited text string with leading and
; trailing CRLFs.
;   Entry: DS:DX - String address
;-----------------------------------------------------------------------------
crlf            db      13,10,"$"

print_string    proc    near
                push    dx                      ;Save entry-level value of DX
                mov     ah,9                    ;Print leading CRLF
                mov     dx,offset crlf
                int     21h
                mov     ah,9                    ;Print text string
                pop     dx
                int     21h
                mov     ah,9                    ;Print trailing CRLF
                mov     dx,offset crlf
                int     21h
                ret                             ;Exit to caller
print_string    endp

;-----------------------------------------------------------------------------
; SETVIDFLAG modifies the video reset flag.
;   Entry: DS:SI - Address of optional sign value.
;-----------------------------------------------------------------------------
setvidflag      proc    near
                mov     al,1                    ;Assume video flag enable
                cmp     byte ptr [si],"-"       ;Check for video flag disable
                jne     setvidflag_1
                dec     al
setvidflag_1:
                mov     es,other_seg            ;Point ES to installed seg
```

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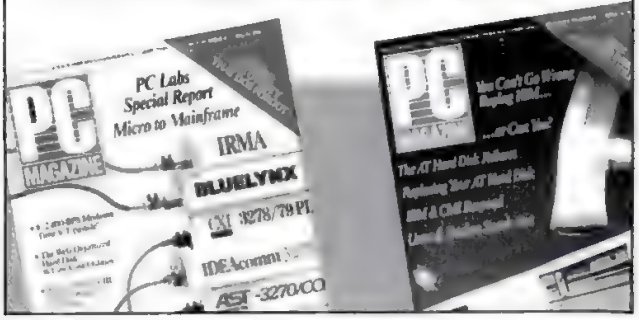

MOVING?

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```
                mov     es:[restorebyvid],al    ;Set/Reset video flag
                clc
                ret
setvidflag      endp

;---------------------------------------------------------------------------
; SETDIM sets the dimmer value.
;   Entry: DS:SI - Address of first digit
;   Exit:  CF set on error (DX points to error message text)
;---------------------------------------------------------------------------
setdim          proc    near
                mov     di,si                   ;Copy command line pointer
                call    asc2bin                 ;Convert ASCII to binary
                mov     dx,offset errmsg8       ;Exit on error
                jc      setdim_error
                cmp     byte ptr [di-1],"-"     ;Negate value if negative
                jne     setdim_1
                neg     ax
setdim_1:
                mov     dx,offset errmsg5
                cmp     ax,63                   ;Error if value is less than
                jg      setdim_error            ;  -63 or greater than +63
                cmp     ax,-63
                jl      setdim_error

                mov     es,other_seg            ;Point ES to installed seg
                mov     es:[dimmer_val],al      ;Record dimmer value
                clc
setdim_exit:
                ret
setdim_error:
                stc
                jmp     short setdim_exit
setdim          endp

;---------------------------------------------------------------------------
; SETDELAY sets the delay counter.
;   Entry: DS:SI - Address of first character past /D switch
;   Exit:  CF set on error (DX points to error message text)
;---------------------------------------------------------------------------
setdelay        proc    near
setdelay_11:
                lodsb
                cmp     al,32                   ;Skip spaces
                je      setdelay_11

                mov     dx,offset errmsg2       ;Error if no delay value
                cmp     al,13                   ;  was specified
                je      setdelay_error

                dec     si                      ;Back up to first character
                call    asc2bin                 ;Convert ASCII to binary
                mov     dx,offset errmsg6       ;Exit on error
                jc      setdelay_error
                mov     bx,0FFFFh               ;If delay value 0, disable
                or      ax,ax                   ;  delay counter with FFFFh
                je      delay_2
                mov     bx,ax                   ;Save delay value
setdelay_12:
                lodsb                           ;Get next character
                cmp     al,32                   ;Skip spaces
                je      setdelay_12
                mov     dx,offset errmsg2       ;Error if no delay value
                cmp     al,13                   ;  was specified
                je      setdelay_error

                mov     di,si                   ;Copy pointer to number
                cmp     al,"-"                  ;Check for leading sign
                je      setdelay_1              ;  identifier
                cmp     al,"+"
                je      setdelay_1
                dec     si                      ;Back up to first character
setdelay_1:
                push    bx                      ;Save delay value
                call    asc2bin                 ;ASCII --> binary
                pop     bx                      ;Retrieve delay value
                mov     dx,offset errmsg8       ;Exit on error
                jc      setdelay_error
                cmp     byte ptr [di-1],"-"     ;Negate value if negative
                jne     delay_1
                neg     ax
delay_1:
                mov     dx,offset errmsg5       ;Check to see if the value
                cmp     ax,63                   ;  is out of range
                jg      setdelay_error
                cmp     ax,-63
                jl      setdelay_error
delay_2:
                mov     es,other_seg            ;Load new delay and dimmer
                mov     es:[delaydimval],al     ;  values into the
                mov     es:[wait_time],bx       ;  program
                mov     es:[dim_counter],bx
```


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DIMMER.ASM


```
                mov     es:[second_cnt],1092
                clc
setdelay_exit:
                ret
setdelay_error:
                stc
                jmp     short setdelay_exit
setdelay        endp

;---------------------------------------------------------------------------
; REMOVE removes a resident copy of the program from memory.
;   Exit: CF set on error
;---------------------------------------------------------------------------
remove          proc    near
                cmp     alrdy_installed,0       ;See if installed
                je      remove_error            ;No, error
                mov     ax,3508h                ;Get timer vector
                int     21h
                mov     ax,es                   ;Check to make sure timer
                cmp     ax,other_seg            ;  vector not modified
                jne     remove_error

                mov     ax,3509h                ;Get keyboard vector
                int     21h
                mov     ax,es                   ;Check to make sure keyboard
                cmp     ax,other_seg            ;  vector not modified
                jne     remove_error

                mov     ax,3510h                ;Get video vector
                int     21h
                mov     ax,es                   ;Check to make sure video
                cmp     ax,other_seg            ;  vector not modified
                jne     remove_error

                push    ds
                lds     dx,es:[int08h]          ;Get old interrupt 8 vector
                mov     ax,2508h                ;Set interrupt
                int     21h
                lds     dx,es:[int09h]          ;Get old interrupt 9 vector
                mov     ax,2509h                ;Set interrupt
                int     21h
                lds     dx,es:[int10h]          ;Get old interrupt 10 vector
                mov     ax,2510h                ;Set interrupt
                int     21h
                pop     ds

                mov     cx,es:[env_segment]
                mov     ah,49h                  ;Free PSP block
                int     21h
                mov     es,cx                   ;Free environment block
                mov     ah,49h
                int     21h
remove_exit:
                clc
remove_exit1:
                ret
remove_error:
                stc
                jmp     remove_exit1
remove          endp

;---------------------------------------------------------------------------
; ASC2BIN Converts an ASCII number pointed to by SI to a hex value.
;   Entry: SI = pointer to ASCII number
;   Exit:  AX = binary value
;          CF set on error
;---------------------------------------------------------------------------
ten             dw      10

asc2bin         proc near
                xor     ax,ax                   ;Clear accumulator
                xor     bx,bx                   ;Clear BX
asc_loop:
                mov     bl,[si]                 ;Get ASCII character
                cmp     bl,13                   ;Done if carriage return or
                je      asc_exit                ;  space encountered
                cmp     bl,32
                je      asc_exit
                inc     si
                sub     bl,"0"                  ;ASCII --> binary
                jb      asc_error               ;Error if binary value is
                cmp     bl,9                    ;  less than 0 or greater
                ja      asc_error               ;  than 9
                mul     ten                     ;Multiply accumulator by 10
                add     ax,bx                   ;Add last digit to sum
                jmp     short asc_loop          ;Loop until done
asc_exit:
                clc
asc_exit1:
                ret
asc_error:
                stc
                jmp     short asc_exit1
asc2bin         endp

code            ends

                end     main
```

DIMMER.BAS

COMPLETE LISTING

```
100 REM - BASIC PROGRAM TO CREATE DIMMER.COM
110 CLS:PRINT "Creating DIMMER.COM   ": OPEN "DIMMER.COM  " AS #1 LEN = 1
120 FIELD #1, 1 AS A$: CHECKSUM#=0
130 FOR I = 1 TO    87
140  LINESUM#=0: LOCATE 2,3: PRINT "Countdown: "    87 - I ;
150  FOR J = 1 TO  16: READ BYTE$: BYTE = VAL("&H" + BYTE$)
160   CHECKSUM# = CHECKSUM# + BYTE: LINESUM# = LINESUM# + BYTE
170   IF (BYTE < 256) THEN LSET A$=CHR$(BYTE): PUT #1
180  NEXT J
190  READ LINETOT$: LINECHECK# = VAL("&H"+LINETOT$)
200  IF LINECHECK# = LINESUM# THEN GOTO 220
210  LOCATE 4,2: PRINT "Error in line #"  ;  260 +  10 * I: GOTO 260
220 NEXT I
230 CLOSE: READ FILETOT$ : FILECHECK# = VAL(FILETOT$)
240 IF CHECKSUM# <> FILECHECK# THEN GOTO 260
250 PRINT: PRINT "DIMMER.COM    created successfully": SYSTEM
260 PRINT: PRINT "DIMMER.COM    is not valid!": END
270 DATA E9, F2,  2, 44, 69, 6D, 6D, 65, 72, 20, 31, 2E, 38, 20, 28, 63,    595
280 DATA 29, 20, 31, 39, 38, 39, 20, 5A, 69, 66, 66, 20, 43, 6F, 6D, 6D,  47F
290 DATA 75, 6E, 69, 63, 61, 74, 69, 6F, 6E, 73, 20, 43, 6F, 2E,  D,  A,  554
300 DATA 58, 43, 20, 4D, 61, 67, 61, 7A, 69, 6E, 65, 20, FE, 20, 44, 6F,  5D8
310 DATA 75, 67, 20, 42, 6F, 6C, 69, 6E, 67, 20, 61, 6E, 64, 20, 4A, 65,  579
320 DATA 66, 66, 20, 50, 72, 6F, 73, 69, 73, 65, 24, 1A,  0,  0, FF, FF,  69D
330 DATA FF, FF, 44,  4,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  0,  246
340 DATA  0,  0,  0, 9C, 2E, FF, 1E, 67,  1, FB, 50, 2E, A1, 60,  1, 3D,  507
350 DATA FF, FF, 74, 23,  B, C0, 74, 1F, 2E, FF,  E, 62,  1, 75, 18, 2E,  64C
360 DATA C7,  6, 62,  1, 44,  4, 48, 2E, A3, 60,  1,  B, C8, 75,  8, 2E,  468
370 DATA 8A, 26, 5D,  1, E8,  2,  1, 58, CF, FB, 50, 2E, C7,  6, 62,  1,  5C9
380 DATA 44,  4, 2E, A1, 5E,  1, 2E, 87,  6, 60,  1,  B, C8, 75,  8, 2E,  408
390 DATA 8A, 26, 5C,  1, E8, E2,  0, 1E, B8, 40,  0, 8E, D8, A0, 17,  0,  69A
400 DATA 1F, 24,  F, 3C,  8, 74,  6, 58, 2E, FF, 2E, 6B,  1, E4, 60, 3C,  4AF
410 DATA 48, 75,  F, 2E, 80, 3E, 5C,  1, 3F, 7D, 24, 2E, FE,  6, 5C,  1,  484
420 DATA EB, 1D, 3C, 50, 75,  F, 2E, 88, 3E, 5C,  1, C1, 7E, 11, 2E, FE,  5DD
430 DATA  E, 5C,  1, EB,  A, 3C, 47, 75, CE, 2E, C6,  6, 5C,  1,  0, 2E,  4AB
440 DATA 8A, 26, 5C,  1, E8, 92,  0, FA, E4, 61, 0A, E0,  C, 80, E6, 61,  B03
450 DATA 8A, C4, E6, 61, B0, 20, E6, 20, FB, 58, CF, 2E, A3, 65,  1, 9C,  860
460 DATA 2E, FF, 1E, 6F,  1, FB, 50, 2E, 80, 3E, 64,  1,  0, 74, 1F, 2E,  518
470 DATA 83, 3E, 68,  1,  0, 75, 17, 2E, 8A, 26, 5C,  1, E8, 5A,  0, 2E,  459
480 DATA C7,  6, 62,  1, 44,  4, 2E, A1, 5E,  1, 2E, A3, 60,  1, 2E, A1,  4A7
490 DATA 65,  1,  A, E4, 74, 19, 80, FC, 11, 74, 14, 3D, 10, 10, 74,  A,  4D1
500 DATA 3D, 12, 10, 74,  5, 3D, 1B, 10, 75,  D, E8, 49,  0, EB,  8, 2E,  414
510 DATA 8A, 26, 5C,  1, E8, 22,  0, 58, CF, FC, 51, 52, 56, BE, FF,  2,  6F2
520 DATA BA, C8,  3, 32, C0, FA, EE, B9,  0,  3, BA, C9,  3, AC, E8, 10,  845
530 DATA  0, EE, E2, F9, FB, 5E, 5A, 59, C3, 1E,  E, 1F, E8, DA, FF, 1F,  8C3
540 DATA C3,  A, C0, 74, 10,  2, C4, 3C,  0, 7F,  4, B0,  0, EB,  6, 3C,  573
550 DATA 3F, 76,  2, B0, 3F, C3, FC, 50, 51, 52, 57,  6, 8C, C9, 8E, C1,  759
560 DATA BF, FF,  2, BA, C7,  3, 32, C0, FA, EE, B9,  0,  3, BA, C9,  3,  8E0
570 DATA EC, 24, 3F, AA, E2, FA, FB,  7, 5F, 5A, 59, 58, C3, E8, D6, FF,  9C1
580 DATA 8A, 26, 5C,  1, E8, B2, FF, BA, 60,  0, B8,  0, 31, CD, 21,  0,  697
590 DATA  0,  0,  0, 58, 72, 6F, 67, 72, 61, 6D, 20, 75, 6E, 69, 6E, 73,  525
600 DATA 74, 61, 6C, 6C, 65, 64, 24, 50, 72, 6F, 67, 72, 61, 6D, 20, 6E,  608
610 DATA 6F, 74, 20, 69, 6E, 73, 74, 61, 6C, 6C, 65, 64, 24, 53, 79, 6E,  621
620 DATA 74, 61, 78, 3A, 20, 44, 49, 4D, 4D, 45, 52, 20, 5B, 2F, 55, 5D,  4C1
630 DATA 20, 5B, 2F, 56, 5B, 2B, 7C, 2D, 5D, 5D, 20, 5B, 2F, 44, 20, 6D,  464
640 DATA 6D, 6D, 20, 5B, 2B, 7C, 2D, 5D, 78, 78, 5D, 20, 5B, 5B, 2B, 7C,  550
650 DATA 2D, 5D, 78, 78, 5D, 24, 43, 61, 6E, 27, 74, 20, 75, 6E, 69, 6E,  582
660 DATA 73, 74, 61, 6C, 6C, 24, 56, 47, 41, 20, 72, 65, 71, 75, 69, 72,  5DA
670 DATA 65, 64, 24, 49, 6E, 74, 65, 6E, 73, 69, 74, 79, 20, 76, 61, 6C,  617
680 DATA 75, 65, 20, 6D, 75, 73, 74, 20, 62, 65, 20, 62, 65, 74, 77, 65,  5E1
690 DATA 65, 6E, 20, 2D, 36, 33, 20, 61, 6E, 64, 20, 2B, 36, 33, 24, 49,  3FD
700 DATA 6E, 76, 61, 6C, 69, 64, 20, 64, 65, 6C, 61, 79, 20, 76, 61, 6C,  610
710 DATA 75, 65, 24, 58, 72, 6F, 67, 72, 61, 6D, 20, 61, 6C, 72, 65, 61,  5FB
720 DATA 64, 79, 20, 69, 6E, 73, 74, 61, 6C, 6C, 65, 64, 24, 49, 6E, 76,  60E
730 DATA 61, 6C, 69, 64, 20, 69, 6E, 74, 65, 6E, 73, 69, 74, 79, 20, 76,  637
740 DATA 61, 6C, 75, 65, 24, FC, C7,  6,  0,  1,  0,  0, 33, DB, 8C, C8,  5F7
750 DATA 43, 8E, C3, 3B, C3, 74, 10, BE,  0,  1, 0B, FE, B9, 10,  0, F3,  71A
760 DATA A6, 75, ED, FE,  6, FF,  2, 0C,  6,  0,  3, B8,  0, 1A, CD, 10,  651
770 DATA BA, 76,  3, 3C, 1A, 75, 7E, BE, 81,  0, AC, 3C, 20, 74, FB, 3C,  66E
780 DATA D, 74, 61, 3C, 2F, 75, 14, AC,  C, 20, 3C, 75, 74, 39, 3C, 64,  4AC
790 DATA 74, 29, 3C, 76, 74, 20, BA, 2D,  3, EB, 5A, 3C, 2D, 74,  D, 3C,  538
800 DATA 2B, 74,  9, 3C, 30, 72, EF, 3C, 39, 77, EB, 4E, 80,  E,  2,  3,  52D
810 DATA  1, E8, D9,  0, EB,  D, E8, C1,  0, EB,  0, 80,  E,  2,  3,  2,  5EB
820 DATA E8, F6,  0, 72, 30, EB, B3, BA, 17,  3, 80, 3E, FF,  2,  0, 74,  725
830 DATA 24, E8, 57,  1, BA, 66,  3, 72, 1C, BA,  3,  3, E8, 86,  0, B8,  5FB
840 DATA  0, 4C, CD, 21, 80, 3E, FF,  2,  0, 74, 2F, 80, 3E,  2,  3,  0,  45F
850 DATA 75,  D, BA, C3,  3, E8, 6D,  0, B8,  1, 4C, CD, 21, F6,  6,  2,  646
860 DATA  3,  1, 74,  F, 1E, 8E, 1E,  0,  3, 0A, 26, 5C,  1, E8, C9, FD,  50F
870 DATA 1F, EB, CC, F6,  6,  2,  3,  2, 75, C5, B8,  8, 35, CD, 21, 89,  67F
880 DATA 1E, 67,  1, 8C,  6, 69,  1, B8,  8, 25, BA, 73,  1, CD, 21, B8,  53B
890 DATA  9, 35, CD, 21, 89, 1E, 6B,  1, 8C,  6, 6D,  1, B8,  9, 25, BA,  4DF
900 DATA A9,  1, CD, 21, B8, 10, 35, CD, 21, 89, 1E, 6F,  1, 8C,  6, 71,  59D
910 DATA  1, B8, 10, 25, BA, 2B,  2, CD, 21, BA,  3,  1, E8,  6,  0, E9,  558
920 DATA DB, FD,  D,  A, 24, 52, B4,  9, BA, 12,  5, CD, 21, B4,  9, 5A,  5F8
930 DATA CD, 21, B4,  9, BA, 12,  5, CD, 21, C3, B0,  1, 80, 3C, 20, 75,  63C
940 DATA  2, FE, C0, 8E,  6,  8,  3, 26, A2, 64,  1, F8, C3, 8B, FE, E8,  7B0
950 DATA FD,  0, BA, DD,  3, 72, 1F, 80, 7D, FF, 2D, 75,  2, F7, D8, BA,  851
960 DATA 83,  3, 3D, 3F,  0, 7F,  F, 3D, C1, FF, 7C,  A, 8E,  6,  0,  3,  4AA
970 DATA 26, A2, 5C,  1, F8, C3, F9, EB, FC, AC, 3C, 20, 74, FB, BA, 2D,  91E
980 DATA  3, 3C,  D, 74, 63, 4E, E8, C6,  8, BA, AF,  3, 72, 5A, 8B, FF,  711
990 DATA FF,  B, C8, 74, 38, 8B, D8, AC, 3C, 20, 74, FB, BA, 2D,  3, 3C,  776
1000 DATA  D, 74, 45, 8B, FE, 3C, 2D, 74,  5, 3C, 2B, 74,  1, 4E, 53, E8,  596
1010 DATA 9D,  0, 5B, BA, DD,  3, 72, 30, 80, 7D, FF, 2D, 75,  2, F7, D8,  7A3
1020 DATA BA, 83,  3, 3D, 3F,  0, 7F, 20, 3D, C1, FF, 7C, 1B, 8E,  6,  0,  583
1030 DATA  3, 26, A2, 5D,  1, 26, 89, 1E, 5E,  1, 26, 89, 1E, 60,  1, 26,  3A9
1040 DATA C7,  6, 62,  1, 44,  4, F8, C3, F9, EB, FC, 80, 3E, FF,  2,  0,  7D2
1050 DATA 74, 58, B8,  0, 35, CD, 21, 8C, C0, 3B,  6,  0,  3, 75, 4B, B8,  5B7
1060 DATA  9, 35, CD, 21, 8C, C0, 3B,  6,  0,  3, 75, 3E, B8, 10, 35, CD,  539
1070 DATA 21, 8C, C0, 3B,  6,  0,  3, 75, 31, 1E, 26, C5, 16, 67,  1, B8,  496
1080 DATA  8, 25, CD, 21, 26, C5, 16, 6B,  1, B8,  9, 25, CD, 21, 26, C5,  547
1090 DATA 16, 6F,  1, B8, 10, 25, CD, 21, 1F, 26, 8B,  E, 2C,  0, B4, 49,  468
1100 DATA CD, 21, 8E, C1, B4, 49, CD, 21, F8, C3, F9, EB, FC,  A,  0, 33,  900
1110 DATA C0, 33, DB, 8A, 1C, 80, FB,  D, 74, 18, 80, FB, 20, 74, 13, 46,  6F0
1120 DATA 80, EB, 30, 72,  F, 80, FB,  9, 77,  A, F7, 26, 3D,  6,  3, C3,  647
1130 DATA E8, E1, F8, C3, F9, EB, FC,  0,  0,  0,  0,  0,  0,  0,  0,  0,  667
1140 DATA 131667
```

DIMMER.BAS: Running this BASIC program will automatically produce the DIMMER utility.

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DIMMER Command

Douglas Boling and Jeff Prosise October 17, 1989 (Utilities)

Purpose: To provide software control of VGA monitor brightness interactively from the keyboard, through parameters entered on the command line, or at a specified interval after the last keystroke.

Format: **`DIMMER [[+|-]adj] [/D time [+|-]adj] [/V[+|-]] [/U]`**

Remarks: Entered without any of its optional parameters, DIMMER uses the Alt–Up Arrow and Alt–Down Arrow keys to increase or decrease screen brightness. The original intensity level can be restored at any time by pressing Alt-Home. DIMMER is a memory-resident program (see **Note**); it can be uninstalled by being run with the /U switch.

The *adj* parameter accepts integer values from +63 to -63. Though relative to the intensity level in effect when the program loads, a value of -63 will completely blank the screen and +63 will wash out almost all colors. The *time* parameter sets the number of minutes (up to 65,534) to allow after the last keystroke. Used in conjunction with the optional /D switch and an *adj* value (usually -63), the *time* parameter is normally used when you want to blank the screen after a specified period of keyboard inactivity. The screen will be restored to its original level when any key is pressed, but since this keystroke will be fed to the application, it is safest to hit an unaccompanied Ctrl, Alt, or Shift key. Once active, the screen-saver option can be cancelled by entering `DIMMER /D 0`.

With applications that do not write directly to the video BIOS, a blanked screen can be automatically restored when the program attempts to update the display. This is accomplished by using the optional /V (or V+) switch. By default, DIMMER restores the intensity level only when a keystroke is entered, which is equivalent to running the program with a /V command-line switch.

Note: While DIMMER is compatible with most application software, problems can be expected with programs that directly manipulate the color registers or that take over interrupts 8h, 9h, or 10h. In particular, DIMMER should not be used when running *Microsoft Windows*.

To create DIMMER.COM from the DIMMER.ASM source code requires the use of a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM DIMMER;
LINK DIMMER;
EXE2BIN DIMMER DIMMER.COM
```


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10h function to update the screen. DIMMER restores the color registers (and thus the display intensity) after each video-mode reset. Moreover, as we'll see in a moment, DIMMER uses interrupt 10h to try to accommodate programs that manipulate the VGA color registers—even though *compatibility*, in such situations, is a rather equivocal term.

SOFTWARE COMPATIBILITY

DIMMER has been tested with a variety of commercially available application programs and found to be compatible with most. Very few programs make use of the special features of the VGA, and fewer still manipulate the VGA color registers. One piece of good news is that whether a program runs in text or graphics mode makes no difference; DIMMER works as well with *AutoCAD* as it does with *WordPerfect* or on the DOS command-line screen.

There are unavoidable incompatibilities, however, when you run DIMMER with application programs which themselves manipulate the color registers. *Microsoft Windows*, for example, resets the color registers when it is run on a VGA, effectively nullifying any adjustments to the registers made earlier by DIMMER. *Windows* also services the keyboard interrupt itself and intercepts presses of Alt–Up Arrow, Alt–Down Arrow, and Alt-Home. This prevents DIMMER from adjusting display intensity with *Windows* running. Since *Windows* restores the color registers to their entry-level values upon termination, if you had DIMMER installed when *Windows* was activated, it should still be working when you go back to the DOS prompt. On the other hand, however, if DIMMER's screen saver blanks the display while *Windows* is active, you won't be able to restore the screen without exiting *Windows*—not an easy task to accomplish when you can't see the screen.

DIMMER does the best it can to work harmoniously even with programs that modify the color registers. If a program uses BIOS routines to write new values to any of the color registers, DIMMER permits the writes and then records the new state of the color registers as its own "home" state. But if a program manipulates the color registers directly—as DIMMER itself does—then the next time you adjust intensity with DIMMER, the changes effected by the other application will be wiped out. Unfortunately, there's nothing DIMMER can do to trap direct writes to the I/O ports.

Programs that take over the keyboard interrupt and service keystrokes in nonstandard ways might also exhibit incompatibilities with DIMMER. The *Microsoft Flight Simulator*, for example, is compatible with DIMMER in all but one respect. When you press Alt and an arrow key to brighten or dim the display, the arrow key also registers on *Flight Simulator*, where it raises or lowers the airplane's elevators. You're in for a nasty surprise when you press Alt–Down Arrow a few times to dim the display only to find that your plane has nosed into a stall. The obvious solution is to lay off DIMMER's control keys while *Flight Simulator* is running or to uninstall DIMMER before *Flight Simulator* is even started.

The VGA color registers provide application programmers with untold new possibilities. In *Flight Simulator*, for example, the day is simply divided into four distinct lighting periods (dawn, daytime, dusk, and nighttime), the view through the windshield being painted a little differently for each. On a VGA-equipped system, a *Flight Simulator*-type program could assign a single color register to handle the color of the sky, so that as an orange sun sank gradually over the horizon the daytime sky would gradually fade into night so smooothly you'd swear you were looking at the real thing.

That's what the future holds for PC users—more-sophisticated software based on more-advanced hardware. To learn more about programming the VGA and other video cards, you should check out Richard Wilton's *Programmer's Guide to PC & PS/2 Video Systems* (1987, Microsoft Press). This book is a comprehensive guide to the internals of the entire family of IBM-standard video adapters, including the Hercules Graphics Card.

And, of course, you don't have to know anything about the VGA to use DIMMER; just install it and try it out. The Programmer General warns, however: it's subtly habit-forming. ■

Douglas Boling is an electrical engineer who has been involved in the design of computer hardware and software for 11 years. Jeff Prosise is a contributing editor of PC Magazine.

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CIRCLE 136 ON READER SERVICE CARD

by
Charles Petzold

Environments

The Marriage of Text and Graphics, Part 1

■ Diehards may not admit it, and it's no simple feat, but the key to proper text display lies in the OS/2 Graphics Programming Interface.

Any graphics system can draw a line. Lines are easy. And any graphics system can display text. But text can be a real monster. The little pictures that make up the letters of our alphabet are obviously the most important graphics images a computer can draw. Yet displaying text—so simple and straightforward in character-mode—is the most complex and difficult area of computer graphics.

In this and in the next Environments column, I want to explore the complexities of handling text in a graphical environment. More specifically, I'll be talking about how fonts are implemented in the Graphics Programming Interface (GPI) of the OS/2 Presentation Manager. This will lead us to a general consideration of GPI's strengths, its weaknesses, and some possible directions for its future.

Before I begin, let me share with you my personal manifesto on the nature of text in a graphical environment.

BEYOND THE FIXED-PITCH FONT

Satisfactory text reproduction imposes more complex requirements in graphical environments, because we have higher expectations for it. In character mode we're satisfied with a fixed-pitch font (a font in which all characters have the same width) because that is an intrinsic limitation of character-mode technology. With graphics, this limitation goes away, and we often want something better.

The fixed-pitch font was originally created for the typewriter. Before that invention, through hundreds of years of typographical tradition and evolution, it never occurred to *anyone* to design a font in which an *i* took up the same amount of space as a *W*. Such a design simply made no sense. Fonts were always proportionally spaced. But the technical limitations of the typewriter required that every character have the same width, so the fixed-pitch font was born. It has survived into the computer age, because of similar technical limitations in computer hardware.

The fixed-pitch font is a typographical absurdity. It is both wasteful of space and more difficult to read than all but special-purpose proportional fonts. If all of the articles in this magazine were printed in a fixed-pitch font, you probably wouldn't read them regardless of their content. The magazine would look cheap, unprofessional, and bland.

If you never thought about this before, take a look at Figure 1. This figure shows the first paragraph of Mark Twain's *Adventures of Huckleberry Finn* printed on a PostScript printer in two fonts: a 10-point Courier (a fixed-pitch typewriterlike font) and a 10-point Times Roman (a proportional font often used in books and magazines). Both samples have an 11-point line spacing. I think it is obvious not only which rendering takes up less space but also which is easier to read.

In the OS/2 Presentation Manager, the default system font (the one programs use if they do not request a different font) is a proportionally spaced Helvetica. This represents a big change from the fixed-pitch system font used by *Microsoft Windows*. People often remark that while they're not quite sure why, Presentation Manager screens look better than *Windows* screens. The secret? It's the proportional font.

Figure 2 shows this proportional font in one of the Presentation Manager Help windows. Personally, I find this font more readable than any fixed-pitch font I've ever seen on a computer screen. As we use our computers more and more to access information through CD-ROM or on-line services, we're going to need an environment in which we can read on-screen text with the same ease that we read printed documents; a proportional font will help considerably.

With the availability of inexpensive laser printers, it has become possible to produce professional-looking documents with our personal computers. Typographers have known for centuries how the use of different fonts, sizes, line spacing, and other factors can affect the tone of a document, sometimes subtly and sometimes not so subtly. Putting the power of font selection and manipulation into the personal computer is an important step in the PC's evolution. (Of course, anyone who has seen the work of amateur desktop publishers realizes how easily this power can be abused. Restraint should be Lesson One in good graphic design.)

From the programmer's perspective, proportional fonts are much more difficult to implement than are fixed-pitch fonts. Every character in a fixed-pitch font has the same width, so it's easy for a program to calculate how many characters will fit in a particular space. It's a snap to show on the screen what will be printed on a printer. A proportional font adds obvious complexities to this process. Yet, the results

are well worth the extra effort.

People who work mostly with text and numbers on their PCs sometimes question why graphics are necessary. However, these are precisely the people who should be embracing graphics most fervently! It's very simple: the proper display of text requires a proportional font, and a proportional font requires graphics. Therefore, anyone who really cares about text should take as his goal the eventual banishment of the fixed-pitch font, save only for such specialized applications as hex dumps and program listings.

The distinction we often draw between text and graphics is essentially artificial. It arises from the (temporary) limitations imposed by primitive computer hardware. In the real world, text *is* graphics, and the proper rendering of text is the highest achievement of the graphic arts. Consequently, there can be no greater goal of a graphics programming system than to allow us to work with text in a powerful and flexible manner.

THE GRAPHICS BATTLEGROUND

We're entering a decade of computing, in which the graphical user interface (GUI) will be a common sight on computers of all shapes and sizes. Debates will not center on the validity of the GUI, or on whether a machine that has a GUI is better than one that does not. Debates will focus instead on which is the *best* GUI.

A major part of any graphical interface is its underlying graphics programming system. The Macintosh has *QuickDraw; Microsoft Windows* has the Graphics Device Interface (GDI), the Presentation Manager has the Graphics Programming Interface (GPI); the NeXT computer has Display PostScript; Unix has the X-Window system, which includes a graphics system; and Sun has NeWS, which includes a PostScript-like graphics language.

Although these graphics systems can be compared in many ways, in the years ahead I think that their text-handling ability will become an increasingly important consideration. We will ask: how flexible is the font-selection logic? Can the fonts be manipulated, and in what ways? How quickly can the system display text? Is there a good match between printer fonts and screen fonts? And most importantly: is the text displayed on the screen and on printed page attractive and readable?

Achieving a satisfactory answer to these questions is not easy, especially in an open-architecture market such as the one that has grown around the IBM PC. For example, matching screen fonts and printer fonts becomes an enormous problem when you consider all the combinations of video displays and printers that can be connected to an IBM-compatible machine.

To understand the concepts and problems involved with text in a graphics system, let's begin by examining the current font-selection and -generation techniques used in the OS/2 Graphics Programming Interface.

BASIC PM TEXT AND FONT FUNCTIONS

A Presentation Manager program uses the same GPI functions for displaying text on its window as on a hard-copy device, such as a printer, plotter, or digital camera.

There are four text-output functions: GpiCharString, GpiCharStringAt, GpiCharStringPos, and GpiCharStringPosAt. All these functions display a text string beginning from a reference point—either the current known position or a point specified in the function itself. The two functions containing the word *Pos* allow passing an array of increments for nondefault intercharacter spacing of the letters in the string. This is useful for full, left-right text justification. Several additional GPI functions allow a program to draw text at an angle (GpiSetCharAngle), to tilt the characters to achieve a sheared or oblique effect (GpiSetCharShear), and the like.

Text is usually displayed in a default font. For the video display, this default is the proportionally spaced system font used in PM title bars, menus, dialog boxes, and so forth. For printers, the default font can be just about anything. (Some printer drivers even allow the user to specify the default font in a printer-setup dialog box invoked from the Control Panel.)

A program can specify use of a different font by first setting up a FATTRS (font attributes) structure and calling GpiCreateLogFont. The FATTRS structure contains a description of the font—the typeface name, its size, and attributes, such as boldface, italics, and underline. A call to GpiSetCharSet will cause the GPI to use this font to display subsequent text.

Programs often have to obtain information about the current font. This is the job

FIXED-PITCH VS. PROPORTIONAL FONTS

PostScript 'Courier' font

```
You don't know about me,
without you have read a
book by the name of "The
Adventures of Tom Sawyer,"
but that ain't no matter.
That book was made by Mr.
Mark Twain, and he told the
truth, mainly. There was
things which he stretched,
but mainly he told the
truth. That is nothing. I
never seen anybody but
lied, one time or another,
without it was Aunt Polly,
or the widow, or maybe
Mary. Aunt Polly--Tom's
Aunt Polly, she is--and
Mary, and the Widow
Douglas, is all told about
in that book--which is
mostly a true book; with
some stretchers, as I said
before.
```

PostScript 'Times-Roman' font

You don't know about me, without you have read a book by the name of "The Adventures of Tom Sawyer," but that ain't no matter. That book was made by Mr. Mark Twain, and he told the truth, mainly. There was things which he stretched, but mainly he told the truth. That is nothing. I never seen anybody but lied, one time or another, without it was Aunt Polly, or the widow, or maybe Mary. Aunt Polly--Tom's Aunt Polly, she is--and Mary, and the Widow Douglas, is all told about in that book--which is mostly a true book; with some stretchers, as I said before.

Figure 1: Looking at the Courier (left) and Times Roman (right) renditions of the same printed paragraph, would anyone really prefer the monospace over the proportional font?

of GpiQueryFontMetrics, which uses the FONTMETRICS structure to return various font dimensions and characteristics. (The FONTMETRICS structure has 49 fields and is the largest structure in the Presentation Manager API.) The GpiQueryTextBox function returns the dimensions of a text string in terms of the coordinates of the corners of a box that, if displayed, would enclose the string. GpiQueryCharStringPosAt returns an array of increments that indicate the point at which each character in a string begins. The GpiQueryWidthTable function lets a program obtain the widths of all the characters in the font.

A program can use GpiQueryFonts to obtain FONTMETRICS structures for all the fonts available for a particular graphics output device. In a practical sense, this function is a prerequisite for any but the most basic use of fonts.

DEVICE FONTS, GENERIC FONTS

The fonts available to a particular graphics output device can be categorized in various ways. One very important distinction is that between *device* fonts and *generic* fonts.

Device fonts are intrinsic, built into the device. Most printers have several device fonts stored in ROM somewhere in their internals. Device fonts also include the additional printer fonts stored in ROM cartridges and fonts stored in disk files and downloaded to the printer. Device fonts are most often found in printers rather than in video displays, but some sophisticated video display adapters may also have device fonts. (Of course, there is at least one font stored in ROM on most video adapter boards, but this font is used only in character mode and not in graphics mode.)

Generic fonts, sometimes referred to as "engine" fonts, are stored in OS/2 dynamic link libraries. These files are usually resource-only libraries that have a .FON filename extension. The retail version of OS/2 1.1 comes with three such generic font files: COURIER.FON, HELV.FON, and TIMES.FON, which contain Courier, Helvetica, and Times Roman fonts. Courier is a fixed-pitch font; Helvetica and Times Roman are proportional fonts. The system font is stored in DISPLAY.DLL, the device driver for the video display.

(The Helvetica and Times Roman fonts in OS/2 1.1 are not so called, because these specific names are registered trademarks of the Linotype Corporation. The names used in OS/2 are "Helv" and "Tms Rmn.")

When a program calls GpiQueryFonts for a printer presentation space, the function obtains information about both the device fonts and generic fonts available for the printer. Similarly, calling GpiQueryFonts for a window presentation space obtains all the fonts available on the video display.

Of course, none of the printer device fonts will be available on the video display. Moreover, as we'll see shortly, some generic fonts that are available for the video display will not be available for some printers.

RASTERS AND VECTORS

The GPI generic fonts can themselves be subdivided into two categories: *raster* fonts (also called "image" fonts) and *vector* fonts (also called outline fonts). The words *raster* and *vector* denote different ways in which the fonts are stored in the .FON files and rendered on the output device; the distinction is very important in the field of computer graphics.

The word *raster* was first used in television technology to describe that area on a cathode-ray tube where the scan lines are drawn. In graphics programming, however, the word has come to refer to the construction of an image from tiny dots, called pixels or pels (picture elements). The word *vector* comes from mathematics; in computer graphics it refers to the construction of an image from lines and filled areas.

Graphics output devices are either raster devices or vector devices. Most graphics output devices in common use today are raster devices. These include video displays, dot matrix printers, and laser printers. Pen plotters are different: plotters draw lines rather than dots. Thus, a plotter is a vector output device. Interestingly enough, in the early days of computer graphics—the mid-1960s—video displays also were vector devices and operated much like oscilloscopes. The raster display in common use today was a later development.

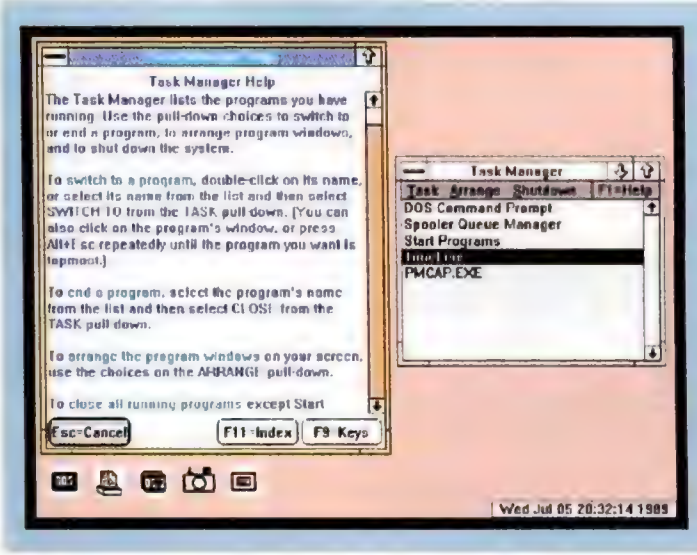

Figure 2: Unlike *Windows*, the Presentation Manager uses a proportionally spaced font (Helvetica) as its system default font. This not only improves the appearance of PM screens, but makes them easier to read as well.

We can also use the words *vector* and *raster* to describe how a computer program stores and renders a graphics image. The GPI in the Presentation Manager supports both vector and raster techniques.

The raster graphics approach involves storing an image as a *bitmap*. A bitmap is simply a two-dimensional array of bits. The rows and columns of bits correspond to rows and columns of pixels on an output device, such as the video display. In a monochrome bitmap, each bit corresponds to one pixel. Color bitmaps require two or more bits for each pixel. A program can display a bitmap on an output device using a `bitblt` (bit block transfer) operation.

The basic problem with using bitmaps, however, is that they are always a set size (the number of rows and number of pixels in the image). This is, in turn, tied to a particular device resolution. You *can* display a bitmap in a smaller or larger size, but the result is often unsatisfactory. If you need to shrink a bitmap, for example, you must eliminate whole rows and columns of pixels from the image, and this may mean the loss of important image information. To expand the bitmap beyond its original size,

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some rows or columns of pixels must be doubled or tripled, perhaps even quadrupled. This produces a grainy appearance, particularly in curved lines and text.

The second approach to storing and rendering graphics objects is known as *vector graphics*. In this approach, the image is described as a series of coordinate points that denote the starting positions and dimensions of straight lines and curves. Filled areas are described by an outline of straight lines and curves. Scaling a vector image to another size is a trivial task for a computer. The GPI can simply apply scaling factors to all the coordinates. Rotating or shearing a vector image is also mathematically easy, whereas rotating a bitmap by an arbitrary angle is algorithmically very difficult.

Both raster graphics and vector graphics have a place in graphics programming. Raster graphics are ideal for storing and rendering digitized photographs, while vector graphics are ideal for architectural drawings. And, when necessary, you can even combine raster graphics and vector graphics techniques.

When a program uses raster graphics to display an image on a raster device, the GPI need simply transfer the pixels of the image to the device. When a program uses vector graphics on a raster device, the GPI must convert the lines and filled areas into a raster image. This is handled within the device driver. (Some devices, such as PostScript printers and video adapters equipped with graphics coprocessors, do this work themselves.) For vector devices such as pen plotters, the device driver can translate a vector image into the control sequences understood by the device. But vector devices are incapable of displaying raster images. You can't draw a bitmap with a plotter.

So far, we've seen that graphics output devices can be categorized as vector or as raster devices and that a Presentation Manager program can store and render a graphic on a device using vector or raster techniques. The GPI generic fonts also come in both raster and vector flavors.

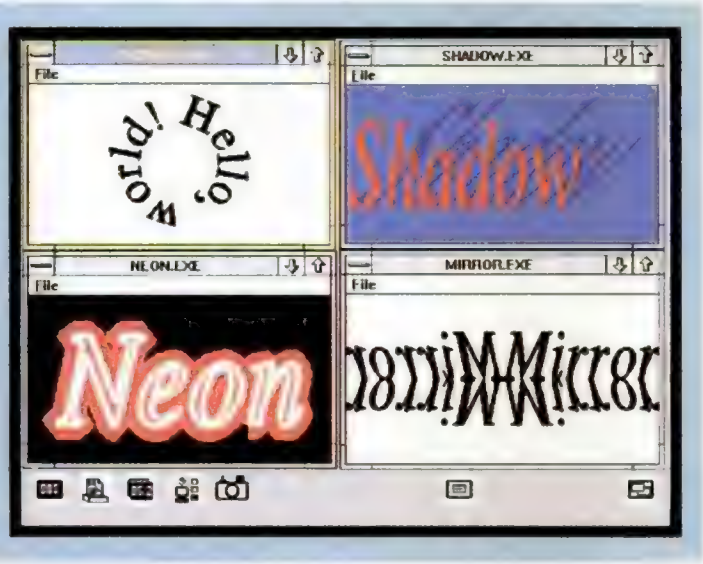

Figure 3: Vector fonts allow text to be manipulated in many different ways because its characters are defined as a series of coordinates.

GPI RASTER FONTS

In a raster font, each character is stored as a tiny bitmap. The rows and columns of bits correspond to the pixels that define the letter. Raster fonts must be individually designed for a specific font size and for a specific display resolution.

Thus, the three .FON files supplied with OS/2 1.1 contain no less than 60 raster fonts. There are Courier fonts in 8-, 10-, and 12-point sizes, and Helvetica and Times Roman fonts in 8, 10, 12, 14, 18, and 24 points. (A point is $^1/_{72}$-inch; the point size denotes the height of the characters in the font.) Each of these fonts is available in four resolutions: those used by the three IBM video adapters (CGA, EGA, and VGA) and the IBM Proprinter. The VGA fonts are also used for the IBM 8514/A. The Proprinter fonts are used for other IBM dot matrix printers.

A Presentation Manager program can use any of these 60 fonts on the video display, of course. However, only those fonts designed for the resolution of the particular video display will look right. The others will be too narrow or too wide. If you have the first version of Borland's *SideKick for Presentation Manager*, you can see this in the NotePad program. NotePad has a bug that causes it to use the Courier font designed for the IBM Proprinter. These characters are too wide for the resolution of the video display.

When a Presentation Manager program chooses a raster font to use on the video display or a printer, it should attempt to find a font designed for the resolution of the output device. If you're interested, the gory details are discussed in Chapter 5 of my book, *Programming the OS/2 Presentation Manager* (Microsoft Press, 1989). Interestingly enough, the raster fonts designed for the video display do not reflect the *actual* resolution of the display. The VGA, for example, has a resolution of about 68 dots per inch, but the VGA raster fonts are designed for a resolution of 96 dpi. This ensures that small font sizes will retain legibility on the video display.

When third-party manufacturers write device drivers for their own video display adapters or for dot matrix printers, they should also create additional raster fonts appropriate for the resolution of the device. They can avoid this job only if one of the standard fonts is appropriate.

Manufacturers of laser printers can also avoid this job because the device always has its own built-in or downloadable fonts. Besides, as the resolution of a device increases, raster font files can become very large, and eventually unwieldy. A raster font for the 300-dpi resolution of most laser printers typically requires about nine times as much data as needed for a VGA font.

Both raster and vector graphics have a place in graphics programming.

The GPI can manipulate the pixels of a raster font to synthesize various text attributes such as boldface, underline, strikeover, and italics. To create an italic font, the GPI can shift some rows of pixels to the right before displaying the character. However, this is about the extent of ma-

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nipulation feasible with raster fonts. The GPI cannot scale a raster font to a different pixel dimension; if you want a 13-point raster font, you're out of luck.

The Presentation Manager is actually a bit more limited in this respect than is the *Windows* program. *Windows* can scale raster fonts by increasing the size in integral multiples. For example, *Windows* can make a 48-point font from a 24-point font by doubling each row of bits. The trade-off involved in using this method, however, is that it creates a graininess in the characters. It's not nearly a perfect solution, and it still doesn't allow you to access every possible font size.

When rendering a character in a vector font, the GPI scales the coordinates to the desired size and fills the area defined by the outline.

GPI VECTOR FONTS

Each of the three font files supplied with OS/2 also contains four vector fonts. These are Courier, Helvetica, and Times Roman in normal, bold, italic, and bold italic variations. Vector fonts are stored as a series of lines and curves that are based on a generalized coordinate system. When rendering a character in a vector font, the GPI scales the coordinates to the desired size and fills the area defined by the outline.

It's not necessary for vector fonts to be available in a variety of point sizes; the GPI can scale the coordinates to the desired size. You can display a 3-point font or a 13-point font or a 288-point font from the same vector-font definition. Nor is it necessary for vector fonts to be designed

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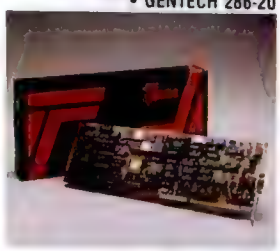

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for a particular device resolution, since the GPI can adjust for the resolution while scaling the coordinates. The GPI vector fonts can be used on any graphics output device that the Presentation Manager supports, including video displays, dot matrix printers, laser printers, and yes, the PM even supports plotters.

Because the characters in a vector font are defined as a series of coordinates connected by lines and curves, the GPI can manipulate the coordinates in various ways. For example, a program can rotate characters so that text runs diagonally up the page, around a circle, or however you want. The GPI can also fill the interior of a vector font with a pattern or use it for a clipping area to restrict subsequent drawing to the inside of the character.

In other words, you can treat a vector-font character like any other complex graphics object. You've probably seen some demonstrations of font manipulation in PostScript, another graphics system that uses vector definitions to define fonts. Virtually everything you can do with fonts in PostScript, you can also do with the GPI vector fonts. An in-depth discussion of the programming considerations involved in manipulating vector fonts can be found in my article, "Exploring Vector Fonts with the OS/2 Presentation Manager," which appeared in the March, 1989, issue of *Microsoft Systems Journal*. Figure 3 shows four examples of such text manipulations.

PERFECT? NOT QUITE

Of course, a need for the crazy things you can do with vector fonts doesn't turn up often in normal everyday work. Still, it's nice to know that you *can* manipulate the fonts like any other vector graphics image. Scaling, in particular, allows vector fonts to be independent of device resolution and point size, quite unlike the rigid and inflexible raster fonts.

Vector fonts represent a marriage of text and graphics that seems to have been made in heaven. You may wonder why we bother with raster fonts at all.

Vector fonts represent a marriage of text and graphics that seems to have been made in heaven. You may wonder why we bother with raster fonts at all.

Unfortunately, marriages are made on earth, and all of them have at least some problems. The GPI vector fonts do have some severe drawbacks. In the next issue I'll discuss these limitations and explore what can be done to improve GPI vector fonts. ■

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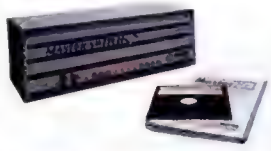

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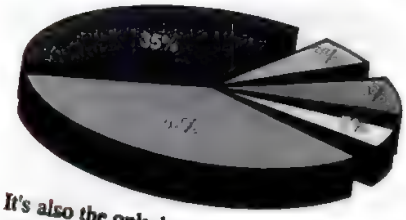

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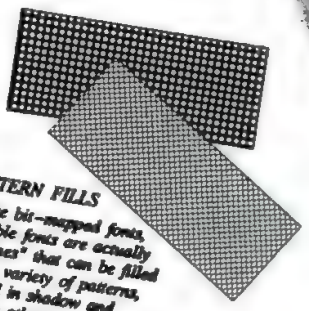

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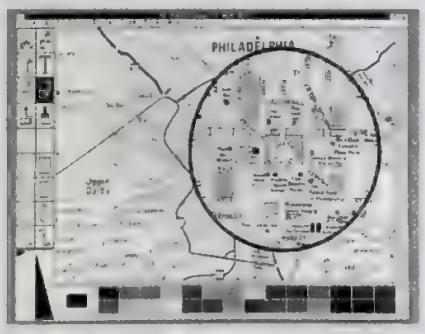

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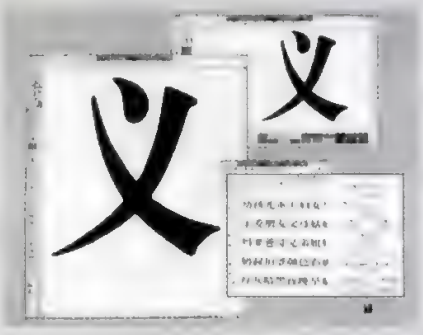

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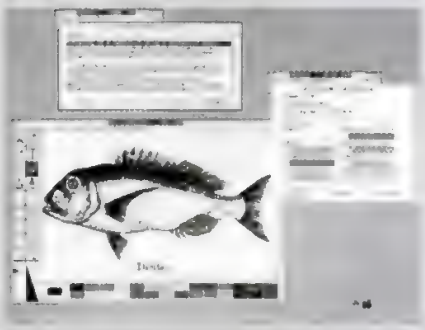

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by
Ray Duncan

Power Programming

Using a DOS Extender Lets You Start 80386 Programming Now

In my previous column, I discussed the many virtues of the 80386 CPU and described some of the tools and environments available for writing true 32-bit, protected-mode applications that take advantage of its capabilities. Even while awaiting the outcome of the 80386 OS wars, I suggested that you get started by using a DOS-based compiler for the 80386 along with with one of the available "DOS extender" programs.

In this installment, I want to cover the basic theory and practice of DOS extenders in somewhat greater detail. The discussion of 80386 protected-mode techniques and the source code presented here next time will assume the use of Phar Lap's assembler, linker, librarian, DOS extender, and virtual memory manager. (I've been using the Phar Lap tools intensively for about one and a half years to build one of my own company's products.) Most of the information will be directly applicable to DOS extenders from other vendors, such as AI Architects. All DOS extenders have essentially the same job to do, and there are only a limited number of ways to do it.

■ Part 2 of this series on 80386 programming looks at what you must do to convert programs to 32-bit protected mode under the control of a DOS extender.

HOW DOS EXTENDERS WORK

A DOS extender is designed to let you run 80386 protected-mode programs on a real-mode operating system (DOS). This is no trivial undertaking, for many of the basic assumptions that DOS makes, on matters ranging from addressing to the availability of interrupt vectors, are fundamentally incompatible with protected-mode execution.

When you buy a commercial package that incorporates a DOS extender, such as *Interleaf Publisher* or *Paradox/386*, you get a single executable file in which the DOS extender and the application program are "bound" together in the structural relationship illustrated in Figure 1. When developing a program of your own, you will typically use an "unbound" version of the DOS extender; that is, one that resides in a separate file from your brainchild. The sequence of events followed by both bound and unbound applications is essentially the same, however.

The DOS extender itself has two major elements: an initialization portion that runs in real mode, and a control program that runs (most of the time) in protected mode. The initialization portion is the only part of the .EXE file recognized by the DOS program loader. During initialization, the DOS extender allocates some conventional memory (below the 640K boundary) for the buffers it will need. It also determines how much extended memory (above the 1MB boundary) is available, taking into account the amount already in use by disk caches, RAMdisks, and the like.

When allocating extended memory, the DOS extender normally follows the VDISK and interrupt 15h conventions I described in the May 30, 1989, installment of this column. However, if another 80386-specific program that uses the Virtual Control Program Interface (VCPI) is already running—such as *386-to-the-Max* or QuarterDeck's QEMM.SYS—the DOS extender will request the memory it needs from the other VCPI-aware program instead. (For more information on the VCPI, see my June 27, 1989, column.)

The DOS extender then loads the actual application, either from its own file (in the case of a bound program) or as a separate file (for an unbound program). As indicated in Figure 2, the application is usually placed in extended memory, leaving the conventional memory not occupied by the DOS extender itself available for other purposes. The DOS extender must perform any necessary load-time relocations on the application's executable image. DOS can't provide this service: it knows nothing about extended memory, and knows even less about 80386 32-bit protected-mode object code.

At this point, the DOS extender builds the global descriptor table, local descriptor table, interrupt descriptor table, and task state segment. These are all special data structures maintained by software but interpreted by the CPU hardware. The DOS extender initializes the CPU registers that point to these structures. It then switches the CPU into protected mode by setting the PE (protect enable) bit in CR0, which is one of the special CPU control registers. Finally, the DOS extender loads up the segment registers with the appropriate selectors and transfers control to the application. The application's entry point was specified by an END statement in its source code.

Seen from its own perspective, the application runs in a "flat" address space whose size is limited only by the amount of installed extended memory and by the disk space available for swapping. (This as-

sumes that your DOS extender supports virtual memory, as Phar Lap's does.) The program runs in a single 80386 memory segment—but that segment can be as large as 4GB! The segment registers all point to the same place (the segment's base), and the application need concern itself only with manipulation of 32-bit offsets within the segment.

So, when we're in the 80386's 32-bit protected mode, we're programming in a memory model that looks remarkably like a DOS .COM program. The major differences are that the program size limitations have (for all practical purposes) disappeared; the values in segment registers are selectors and cannot be arithmetically manipulated; and the selector values in CS and DS are not the same. These values differ (though they refer indirectly to the same physical address) because an executable selector is not writeable and a read/write data selector is not executable.

FUNCTION CALLS AND DOS EXTENDERS

One interesting aspect of application execution under a DOS extender is that the 80386's support for privilege levels is not exploited. In protected-mode operating systems like OS/2 and Unix, only the operating system kernel and drivers run at the highest privilege level (kernel mode), which allows them to manipulate "sensitive" registers, instructions, I/O ports, and data structures. Under these operating systems application programs run at a lower privilege level (user mode). If an application tries to read or write an I/O port, address nonexistent memory, execute an invalid opcode, or otherwise goes astray, a protection fault (similar to a hardware interrupt) is generated, the operating system regains control, and the errant program is terminated.

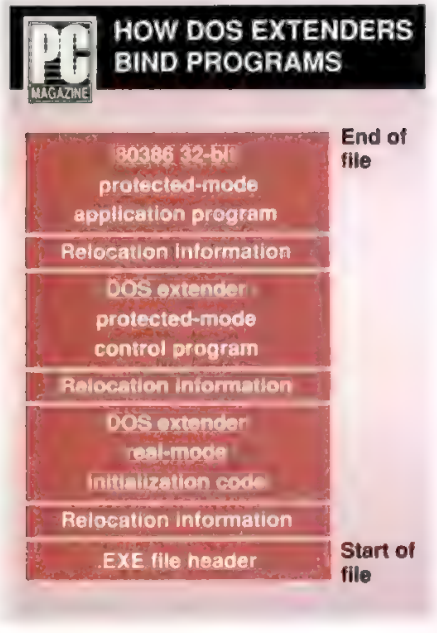

Figure 1: A DOS extender can become an integral part of the 32-bit protected-mode .EXE file, taking over functions that DOS can't handle. The initialization portion of the DOS extender, which first receives control in real mode, is the only part of the file recognized by the DOS program loader.

By contrast, DOS extender applications (as well as the extender itself) run at the highest privilege level, giving them unlimited access to the hardware. One happy side effect of this approach is that the application can execute software interrupts (INT instructions) that are forbidden to an OS/2 or Unix application. In order to invoke a DOS or ROM BIOS function under a DOS extender, an application program need only load up the registers in the familiar way and issue an INT 21h, INT 10h, and so on.

Of course, when the application does execute a software interrupt, it doesn't fall straight into DOS or the ROM BIOS. After all, it is running in protected mode and using the full 32-bit registers, with which neither DOS nor the ROM BIOS can cope. What actually happens is that the DOS extender sets up a protected-mode interrupt vector table and arranges to trap all of the application's requests for DOS or ROM BIOS services.

The actions taken by the DOS extender after it intercepts such a function call depend on the type of function being requested. As diagrammed in Figure 3, there are basically four classes of functions with which the DOS extender must be concerned: functions that require little more than a mode switch; functions that address application buffers and, therefore, require data movement and address remapping; functions that must be completely replaced in order to be meaningful in protected mode; and functions that are unique to the DOS extender itself and provide special services that have no equivalent in DOS or the ROM BIOS.

For the first class of functions—exemplified by character I/O for the console, printer, or serial port—the DOS extender switches the CPU into real mode and passes the request through to DOS or the ROM BIOS essentially unchanged. When DOS or the ROM BIOS returns from the function call, the DOS extender switches the CPU back to protected mode, restores the high 16 bits of each of the general registers (after all, there's no guarantee that they didn't get clobbered somewhere in DOS or a device driver), and returns the results to the application.

The next, somewhat more complex class, includes functions—such as file opens, reads, and writes—in which the application program passes addresses for its own buffers. These protected-mode addresses, which almost always lie above the 1MB boundary, are meaningless to DOS and the ROM BIOS, since the latter two execute in real mode. The DOS extender handles the situation by arranging for the data to be read or written into its own private buffers, below the 640K boundary. In the case of a file write request, for example, the DOS extender intercepts the request, copies the data from the application's buffers in extended memory to another buffer in conventional memory, substitutes the conventional memory buffer address for the original buffer address, switches the CPU into real mode, and finally issues the write function call to DOS.

In order to invoke a DOS or ROM BIOS function under a DOS extender, an application program need only load up the registers in the familiar way and issue an INT 21h, INT 10h, and so on.

In the third class of functions, the DOS extender must replace DOS or ROM BIOS services with new ones appropriate to protected mode. These functions are exemplified by the DOS calls to allocate, resize,

and release blocks of memory (interrupt 21h, functions 48h through 4Ah). The DOS extender contains its own memory manager and responds to these software interrupts by allocating, resizing, or releasing chunks of extended memory in multiples of 4K (the standard memory page size for the 80386). Of course, the functions deal in terms of protected-mode selectors rather than the paragraph addresses used by DOS.

The last class of functions—the services that are made available uniquely by the DOS extender—covers a broad spectrum. For example, there are function calls to translate between real-mode and protected-mode addresses, to manipulate the interrupt descriptor table, to allow a direct call on a real-mode subroutine from a protected-mode application, to allocate chunks of conventional memory, and so on. Most of these function calls are for highly specialized or demanding situations and are therefore not used in typical application programs.

Among the four overall classes are several specific function calls that warrant further comment here. The function calls used to terminate a program, for example—interrupt 20h, interrupt 21h function 00h, and interrupt 21h function 4Ch—require two levels of handling. The DOS extender first fields the call to release the extended memory that was in use by the application and to restore the interrupt vectors captured during its initialization. It then performs its own proper termination to release the conventional memory, file handles, and other resources that DOS allocated to the DOS extender and the application.

The EXEC function (interrupt 21h function 4Bh) is interesting, too. Under DOS, an application program uses EXEC to load and execute a "child" program, and to regain control when the child terminates. The DOS extender allows an application to call EXEC in the manner you'd expect. If the child is a normal real-mode DOS program, it executes in whatever conventional memory remains above the DOS extender control program and its buffers. If, on the other hand, the child program is another DOS extender application, it loads into extended memory above the parent.

Usually, applications that are built on a DOS extender are embedded—that is, the DOS extender is contained in the same file as the application. If one such application EXECs another as a child, then there will be two copies of the DOS extender in memory. The child copy checks for a previously loaded DOS extender and, if it finds one, calls the previous copy to perform memory management rather than doing it itself. This way both applications essentially cooperate by using, for example, the same memory manager and a common set of page tables. The two copies of the DOS extender communicate via the VCPI protocol.

Under DOS, an application program uses EXEC to load and execute a "child" program.

SPECIAL DOS PROGRAMMER NEEDS

There are three issues that arise in the course of normal DOS programming that have not been covered yet by the description I've given of how the DOS extender intercepts function calls. These involve obtaining command line and environment information, performing direct video I/O, and servicing interrupts (typically for fast serial port I/O).

When a normal DOS program is loaded, command line information—the parameters and switches that immediately follow the program name itself—is passed at a fixed offset (80h) within the program segment prefix (PSP). The PSP is always located at the bottom of the main block of memory allocated for the program, and

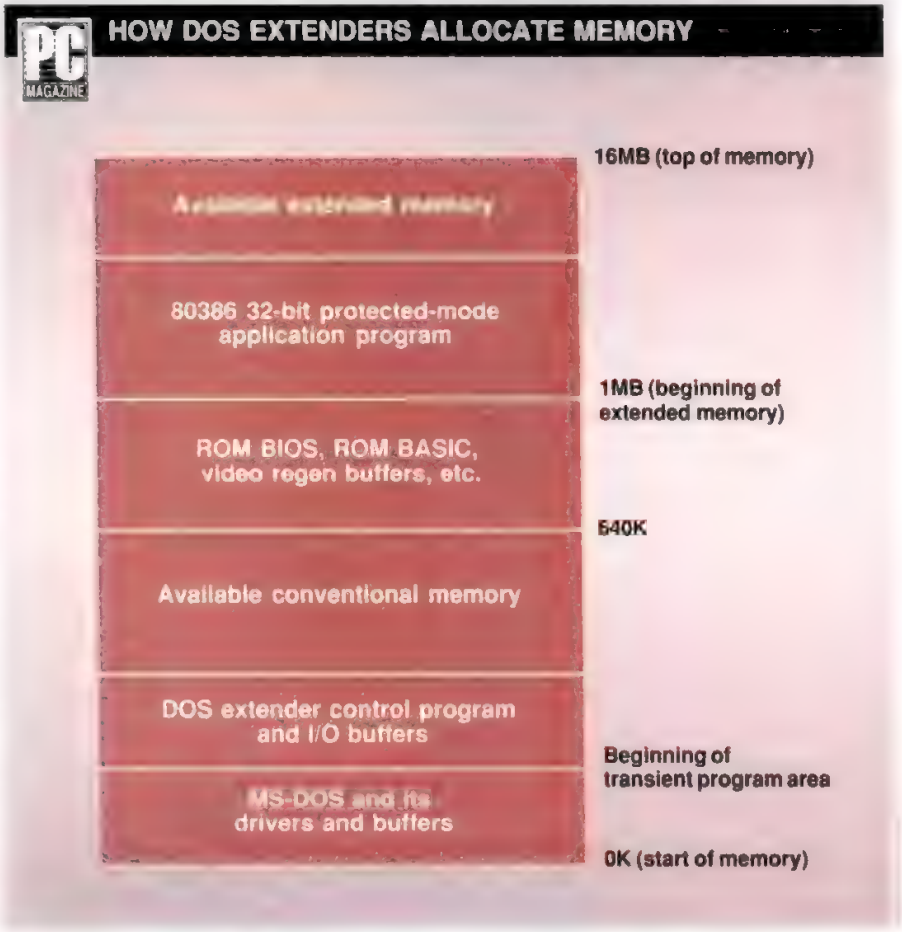

Figure 2: When a DOS extender is used, the protected-mode 80386 application is typically loaded into extended memory. A portion of conventional memory is reserved for the DOS extender's control program and its buffers. The remaining conventional memory is available for execution of real-mode programs under the control of the protected-mode application via the EXEC call.

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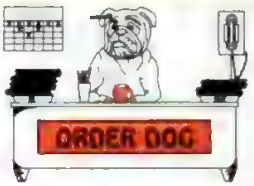

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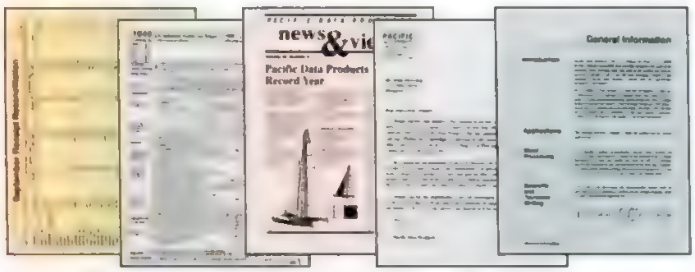

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.EXE-type programs are entered with the address of the PSP in registers DS and ES. (In .COM programs all four segment registers point to the PSP). The environment block is allocated separately, but a pointer to it can be found at offset 2Ch in the PSP.

When a bound 80386 protected-mode application is executed, the DOS extender portion receives the addresses of the command line and environment in the usual manner. By the time the actual application begins running, however, that information is long ago and far away—it's on the other side of the canyon created by a CPU mode switch and the contortions that the DOS extender went through to initialize the protected-mode application's milieu. The DOS extender resolves this dilemma by constructing a "reasonable" PSP and environment that can be used by the application; both of these are addressed by special "hard-wired" selector values that do not change from one execution of the application to another.

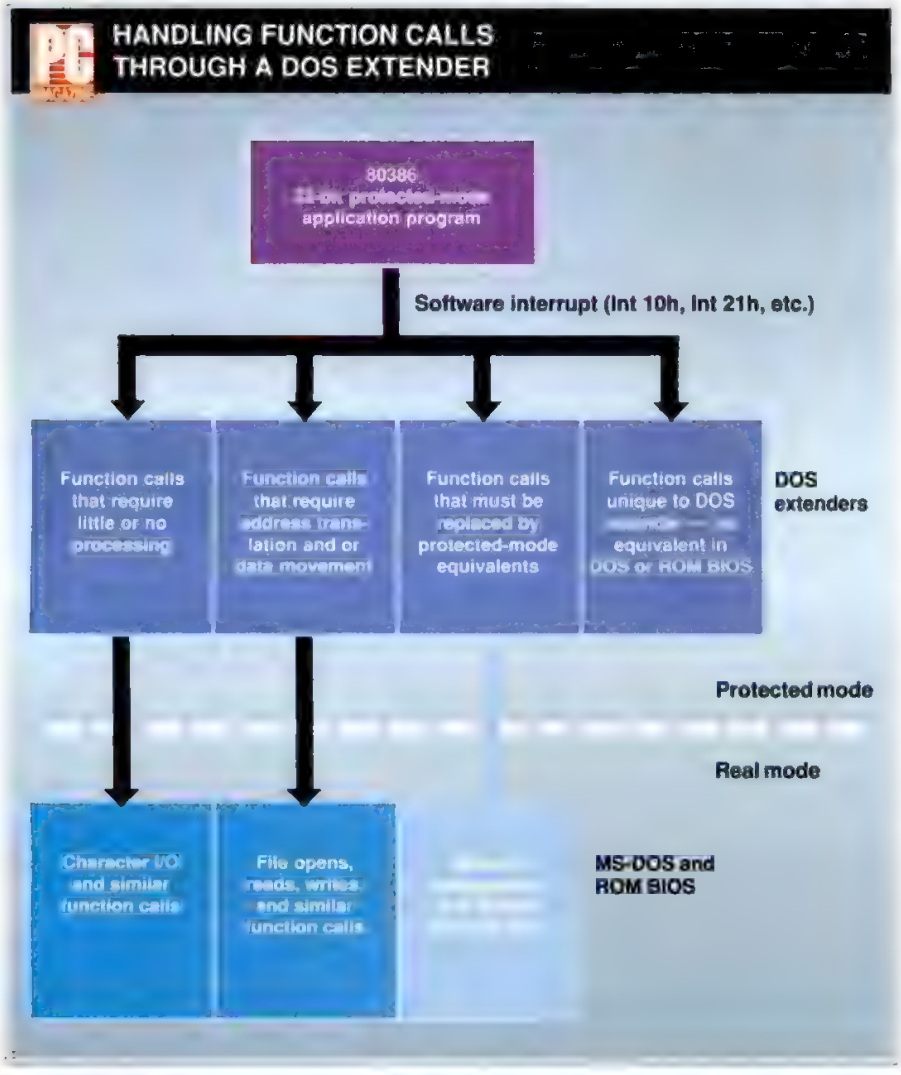

Figure 3: The DOS extender intercepts all DOS and BIOS calls made by an application. This diagram indicates how the functions are handled. The first group requires a simple mode switch back to real mode; when they return, the DOS extender switches back to protected mode. The second group requires translation of protected-mode addresses into real-mode addresses. The DOS extender does this by adjusting addresses so that its own private file buffers, which are located below 640K, are used. It then switches the CPU into real mode and executes the DOS or BIOS functions. On return, addresses are translated back into protected-mode addresses. The third group of functions *must be replaced* by equivalent protected-mode functions supplied by the DOS extender itself. The actual DOS and BIOS functions are *never* called. The final group consists of functions specific to the DOS extender itself.

The problem of direct video I/O—a burden laid on every viable interactive real-mode application by the poor performance of the built-in DOS and ROM BIOS video drivers—is dealt with in a similar way. The DOS extender provides the protected-mode application with two hard-wired selectors that map the video adapter's "regen buffer" and the entire conventional memory area, starting at address 0000:0000h. The application can use these selectors to perform memory-mapped I/O of characters and pixels and to manipulate the ROM BIOS's data area at 0040:0000h. Since DOS extender applications run at the highest privilege level, they can also read and write the video adapter's I/O ports directly in order to program the palette registers, select unsupported display modes, and so forth.

This last issue—that of servicing interrupts from the serial I/O controller and similar devices—probably requires the most care when you are converting a real-mode application for use with a DOS extender. DOS and the ROM BIOS assign the hardware interrupt levels IRQ0 to IRQ7—used for the timer tick, the keyboard, and the serial ports, among other things—to interrupt vectors 8h-0Fh. Unfortunately, these assignments collide with the interrupt vectors used by the 80286 and 80386 CPUs for certain protected-mode error conditions, such as the general protection fault, stack underflow fault, and invalid opcode fault.

To resolve these conflicts, the DOS extender reconfigures the 8259 programmable interrupt controller (PIC) so that IRQ0 through IRQ7 are assigned to interrupt vectors 78h through 7Fh. The extender also provides very flexible facilities that support an application's servicing of hardware interrupts. For example, an application can choose whether to service interrupts that occur when the CPU is in real mode, in protected mode, or both. It can also declare separate real-mode and protected-mode interrupt service routines. If the application needs them, the DOS extender will even perform mode switches at interrupt time so that a protected-mode handler can service an interrupt that occurred when the CPU was in real mode, or vice versa.

CONVERTING REAL-MODE APPLICATIONS

In this and the previous installment, we have identified the following important issues that must be handled when a real-mode DOS application is converted to exe-

cute in 80386 32-bit protected mode under the control of a DOS extender:

- 16-bit instructions must be converted to 32-bit instructions. This can be done fairly mechanically for the most part, although the code often can be shortened and improved by taking advantage of the new 80386 instructions.
- Code that is fundamentally incompatible with protected-mode operation—such as arithmetic operations on the contents of segment registers and/or the use of segment registers as "scratch" storage—must be removed.
- DOS and ROM BIOS function calls must be carefully inspected, and those that are related to memory management must be altered for compatibility with the DOS extender.
- Code that manipulates the video controller, ROM BIOS data area, interrupt vectors, and that services hardware interrupts, requires painstaking analysis and conversion.

Those DOS and ROM BIOS function calls that are related to memory management must be altered for compatibility with the DOS extender.

Next up, I'll give you a practical example of this procedure by converting one of my own venerable utility programs for Phar Lap's DOS extender—called *386/DOS Extender*—and 80386 32-bit protected mode.

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by
Neil J. Rubenking

User-to-User

SELECTING A UNIQUE FILENAME

I sometimes need to create a temporary file from within my batch files. Selecting a unique name can be a problem, especially if you are writing a batch file for use by other people. The following two-line fragment added to a batch file will choose a unique filename for you:

```
SET DEST=CON
FOR %%v IN (20 19 18 17 16 15
 14 13 12 11 10 9 8 7 6 5 4 3 2 1)
 DO IF NOT EXIST $TEMP$%%V.TMP
 SET DEST=$TEMP$%%V.TMP
```

After executing these lines, the environment variable DEST will contain a filename of the form $TEMP$V.TMP. This filename is unique in the current directory. Use %dest% at each place in your batch file where you need the unique name. If choosing a unique name is not possible, DEST will still be equal to its initial value, in this case CON. Test for %dest%==CON and display an error message or, if you prefer, you may simply allow the output that would normally be sent to the file to be sent to the display.

Ronald Q. Smith
Norcross, Georgia

PC MAGAZINE Batch file authors often just guess that an odd filename of their choice won't be in use. I do it myself. But given the number of PC users, *any* hard-coded filename can be a problem. The batch file lines above test to find a safe temporary filename.

The FOR command tests for the existence of every one of the 20 possible filenames—it doesn't stop just because it finds an available one. In fact, it may test and find them all available. Since it tests them in reverse numeric order, the lowest-numbered available file will be the last one assigned to DEST. But the 20 IF EXIST tests take time. As long as your batch files delete any temporary files they create, you should be able to use fewer numbers in the FOR command.

- SELECTING A UNIQUE FILENAME: Polite batch files check to make sure a filename isn't already in use before creating a temporary file.
- NAMING FILES: High-ASCII characters can be useful in filenames, but some should be avoided.
- A FIX FOR BAT_CASE: Here's the updated version of this popular batch file.
- CONTROLLING YOUR CONFIGURATION: Get more control with the BREAK command.
- EASE ROUTINE TYPING CHORES: Here are two methods to ensure you'll never type "A:" again.

NAMING FILES

One of my programs creates several temporary files, which it later deletes. To make sure that the names of these files do not match any files that the user might already have, I use ASCII characters 128 to 255 in the filenames. For example, the following are all valid DOS filenames:

```
±ÇÑ|Ñ▒αβΓ.≤⌐≥
Σ≡MC²
▒▓▒▓▒▓▒▓▒.▒⌐▒
■½■½■1■2.«⌐»
π=3.14
```

Files named using these characters have the added benefit that novices cannot easily delete them since ASCII characters greater than 127 do not have keys on the keyboard. In fact, to make it even more difficult for novices to do unwitting damage, I use ASCII character 255 in the middle of a filename. This simulates ASCII 32, the space character, whose use in a filename is forbidden by DOS. Of course, it is easy enough to delete such files using the tag-and-erase feature of most DOS shells.

One caveat, however: DOS will convert every accented lowercase character to its unaccented uppercase equivalent. For example, if you use â in a filename, DOS will convert it to A. The only exceptions to this are the following characters: ü, é, ä, å, ç, æ, ö, and ñ. These characters have accented uppercase ASCII equivalents, and DOS will convert them to Ü, É, Ä, Å, Ç, Æ, Ö, and Ñ, respectively. This information is not contained in the DOS 3.3 manual.

Kim Agrawal
Pondicherry, India

PC MAGAZINE DOS 2.*x* users won't be able to play with this feature. In versions before 3.0, if you try to create a file with high-ASCII characters in its name, you get a "File creation error."

I've mentioned before that you can use the high-ASCII characters in filenames, but I never noticed the anomaly that Mr. Agrawal points out. Indeed, most of the accented lowercase letters get converted into unaccented uppercase by DOS, just as unaccented lowercase letters do. One minor error in his list—the é character does *not* get converted to É, though you might expect that it would. For safety, avoid using the accented lowercase letters in filenames.

A FIX FOR BAT_CASE

I tried using BAT_CASE, a batch file in the November 29, 1988, User-to-User column. However, I've found that it returns you to :CASE0 only if the value of the incorrect key pressed is less than the lowest value in line 12. If the value of the key is larger, *opt* will be set to the next lower value in this line. For example, if I press the F key, whose value is 70, *opt* will be set to 68.

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User-to-User

The only way I know to solve this problem is to create new values by adding one to each of the existing values, and then place corresponding :CASEnn labels just before or after the :CASE0 label. Could it be DOS 3.3 or my version of GETKEY that is causing this problem, or is there an error in the batch file?

Steve Guss
Tucson, Arizona

It's not DOS and it's not GETKEY—we let an error slip through. I first learned of the problem via PC MagNet, and my solution was almost identical to that described above. The IF ERRORLEVEL *n* test in DOS is true when the ERRORLEVEL is greater than or equal to *n*. So in the original BAT_CASE, an erroneous keystroke will return the largest value less than or equal to the ERRORLEVEL returned by that keystroke.

In the original FOR loop, the values 68, 81, 83, 87, and so on get substituted in turn for the variable %%e in the expression

```
IF ERRORLEVEL %%e SET opt=%%e
```

Suppose the user has pressed the U key, which has a value of 85. On the first pass, the expression IF ERRORLEVEL 68 is true, since 85 is greater than 68. The variable *opt* gets set to 68. The same happens on the next two passes, testing 81 and 83, respectively. On the fourth pass, the IF ERRORLEVEL test returns false, because 85 is less than 87.

Since the numbers are listed in increasing order, all remaining tests will also return false, and *opt* will retain its last value of 83.

The solution is to insert "trap" values that are one greater than each number in the list: 68, 81, and 83 become 68, 69, 81, 82, 83, 84, and so on. Now if the user presses P, which has a value of 80, the batch file interprets it as 69, which is a known error value.

Figure 1 is the fixed version of BAT_CASE.BAT. I've added labels for all the trap values. When the user presses an invalid key, the batch file writes an error message before redisplaying the menu. Note that I broke up the FOR statement into two statements. You can use as many FOR statements as you need, provided that the numbers in the parameter lists are strictly increasing.

GETKEY.COM is a public domain program that returns the ASCII value of a keystroke in ERRORLEVEL. You can obtain the DEBUG script for creating it from the November 29, 1988, User-to-User column.

BAT_CASE.BAT — **COMPLETE LISTING**

```
ECHO OFF
CLS
:MENU
ECHO WHAT would you like to do now?
ECHO     (S) Run Spreadsheet
ECHO     (D) Run Database
ECHO     (W) Run Word Processor
ECHO     (Q) Quit
GETKEY
SET opt=0
REM 68=D, 81=Q, 83=S, 87=W, 100=d, 113=q, 115=s, 119=w
FOR %%e IN (68 69 81 82 83 84 87 88 100) DO IF ERRORLEVEL %%e SET opt=%%e
FOR %%e IN (101 113 114 115 116 119 120) DO IF ERRORLEVEL %%e SET opt=%%e
GOTO CASE%opt%
:CASE0
:CASE69
:CASE82
:CASE84
:CASE88
:CASE101
:CASE114
:CASE116
:CASE120
ECHO That was not a valid option
PAUSE
GOTO MENU

:CASE115
:CASE83
ECHO Pretending to run Spreadsheet
PAUSE
GOTO MENU

:CASE68
:CASE100
ECHO Pretending to run Database
PAUSE
GOTO MENU

:CASE119
:CASE87
ECHO Pretending to run Word Processor
Pause
GOTO MENU

:CASE113
:CASE81
ECHO ENDING it all
```

Figure 1: This new version of BAT_CASE.BAT correctly allows for invalid keystrokes.

CONTROLLING YOUR CONFIGURATION

The CONFIG.CTL utility in the November 29, 1988, Utilities column is a great help. I get additional mileage out of it because the BREAK= command can be set in either CONFIG.SYS *or* AUTOEXEC.BAT.

Instead of making

```
DEVICE=CONFIG.END
```

the last line of the CONFIG.SYS region that you want to control, change it to

```
BREAK=ON  DEVICE=CONFIG.END
```

The end-of-buffer signature, which CONFIG.CTL needs, does not have to be a separate line. DOS ignores the "argument" after BREAK= but CONFIG.CTL sees the pre-parsed DEVICE=CONFIG.END that it needs.

First, there is an esthetic advantage—the DOS message "Unrecognized command in config.sys" is eliminated.

There is also a practical advantage—some changes in CONFIG.SYS, such as deactivating VDISK.SYS, require corresponding changes in AUTOEXEC.BAT. I automate this by changing the BREAK state in one and testing it in the other. BRKSTATE.COM uses DOS interrupt 21h function 33h to test the BREAK state. When you exercise the option of modifying CONFIG.SYS, you can choose whether to deactivate the BREAK=ON statement.

Then in AUTOEXEC.BAT you can test the state left by CONFIG.SYS, set the ERRORLEVEL, branch on it, and set the final

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BREAK state according to your preference. Figure 2 shows how to do this procedure in a separate batch file.

To create BRKSTATE.COM, first create the ASCII file BRKSTATE.SCR shown in Figure 3, including the blank lines before RCX and after Q. Then execute

```
DEBUG < BRKSTATE.SCR
```

Carl White
Cocoa, Florida

Before CONFIG.CTL, you had to do quite a bit to set up a new configuration. You needed to create two files containing your alternate CONFIG.SYS and AUTOEXEC.BAT. To change to the new configuration, you had to rename the two real files to some other name, and rename the alternate files to CONFIG.SYS and AUTOEXEC.BAT. And, to start the new CONFIG.SYS, you had to reboot. Returning to your regular configuration required similar contortions.

CONFIG.CTL gives you the ability to pick and choose your CONFIG.SYS items, without being bound to one or more specific alternative arrangements. It eliminates the need for an alternate CONFIG.SYS file, but it does leave open the possibility that you'll require an alternate AUTOEXEC. For example, if you choose to omit ANSI.SYS, you'll need a PROMPT that doesn't use it. If you remove a RAMdisk, you had better not copy files to that drive.

Communicating via the BREAK state is a clever way to get around this problem. It makes CONFIG.CTL a more complete solution.

CONFIG.BAT COMPLETE LISTING

```
BRKSTATE
IF ErrorLevel 1 GOTO ON
REM - executed if break was off
BREAK=ON
REM Put commands here that should be
REM executed if break was off
GOTO END
:ON
REM Put commands here that should be
REM executed if break was on
:END
```

Figure 2: An exampie of a batch file that branches depending on how the BREAK state was set in CONFIG.SYS.

BRKSTATE.SCR COMPLETE LISTING

```
A100
MOV AX,3300
INT 21
MOV AL,DL
MOV AH,4C
INT 21

RCX
B
N BRKSTATE.COM
W
Q
```

Figure 3: Redirect this file into DEBUG to create BRKSTATE.COM, used by the batch file in Figure 2 to determine how BREAK is set.

EASE ROUTINE TYPING CHORES

I find irritating the amount of typing necessary to change drives and directories, as well as having to use the Shift key to type a colon. With five logical drives on my PC (A: through E:), I had to find an easier way. The batch file C.BAT (Figure 4) does the same job as the following three DOS commands:

```
A> c:
C> cd \subdir     (optional)
C> dir            (optional)
```

To use the batch file, enter one of the following at the command line:

```
A> c
A> c \subdir
A> c \subdir *
A> c *
```

The first command will simply switch you to the C: drive. The second switches to the C: drive and changes the directory to \subdir. The third switches to drive C:, changes the directory to \subdir, and does a DIR as well. And the fourth command switches to drive C: and does a DIR without changing the current directory on that drive. Once you get the hang of it, switching drives and directories becomes a breeze.

Of course, you will need duplicates of this batch file for every logical drive on your system, under the names A.BAT, B.BAT, C.BAT, and so forth. The only change to make is to line 2 in each batch file: make it A:, B:, C:, etc., accordingly.

Joe Cygman
Montreal, Quebec
Canada

Too bad DOS doesn't use some unshifted key to indicate a drive designator. It *is* a pain to have to shift every time you need the colon.

But there is a disadvantage to this meth-

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od. Each of the batch files that you create will take at least one cluster. Depending on your system, that can be from 1K to 4K to store a file of just a few bytes. If the files are useful to you, they're worth the storage. However, there may be another easier and more economical way if you just want to jump from drive to drive without changing subdirectories.

You can use ANSI.SYS key redefinitions to set up single keys that will take you to a given drive. Suppose you want to map F7 through F10 to A: through D:. These lines in your AUTOEXEC.BAT will do the job:

```
PROMPT $e[0;65;"A:";13p
PROMPT $e[0;66;"B:";13p
PROMPT $e[0;67;"C:";13p
PROMPT $e[0;68;"D:";13p
```

Just insert them before your PROMPT pg statement, or whatever prompt you prefer. Now when you press F9 (known by ANSI as 0;67), you'll get the characters C: followed by a carriage return, character 13. Pressing F10 will move you to your D: drive, and so on.

It may be that you merely object to *shifting* to get the colon following the drive letter. ANSI can help again by swapping the definition of colon and semicolon. As before, insert these lines in your AUTOEXEC.BAT file before the statement that sets your prompt:

```
PROMPT $e[58;59p
PROMPT $e[59;58p
```

Now the colon/semicolon key yields a colon when unshifted, a semicolon when shifted. Don't worry about confusion in your word processor or spreadsheet—this change only affects programs that use DOS Standard Input, and the DOS commands and system utilities are about the only programs that do.

C.BAT COMPLETE LISTING

```
ECHO OFF
C:
IF "%1"=="" GOTO End
IF  %1==* GOTO Dir
CD  %1
IF "%2"=="" GOTO End
IF NOT %2==* GOTO End
:Dir
DIR
:End
```

Figure 4: Batch files like C.BAT speed your navigation between different drives.

PRODUCTIVITY TIP

When you use the FIND command on a filename, it inserts that name in the output. If your batch application needs FIND but does not want the filename, just TYPE the file and pipe the output through FIND.

For example,

```
TYPE filename | FIND "word"
```

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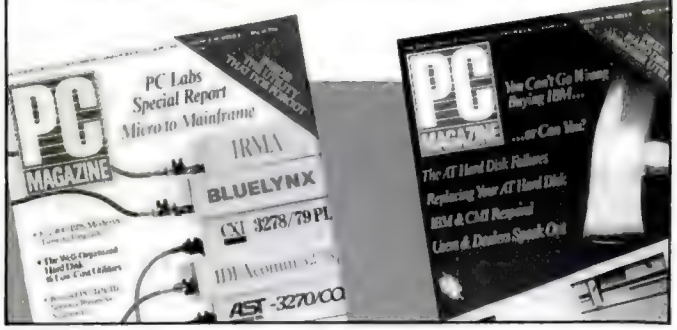

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edited by
Craig L. Stark

Power User

SIZING INSERTS

It's not always possible to import all the figures needed for a document in *Microsoft Word*, particularly when you're preparing a camera-ready manuscript. The macro shown below asks for the amount of blank space to leave in the document in inches, calculates the correct spacing, and inserts the appropriate amount:

```
«ask Spacing = ?Enter the number
 of inches for space»
«set Spacing = Spacing * 6»
<esc>fp<down 2>1<tab>
«spacing»<enter>
```

The best time to invoke the macro is during the final formatting of the document.

Michael Wall
New Orleans, Louisiana

PC MAGAZINE This macro is a little more sophisticated than simply multiplying inches desired by six lines per inch. It uses the Space Before feature of *Word*'s paragraph formatting procedure to insert the proper amount of space above a given paragraph. You can enter the blank space for the figure in fractions of an inch, and the macro will enter the Space Before setting in number of lines or point size, as appropriate. If you enter 3.2 inches, for example, *Word* will calculate the value of 230.4 points.

Be forewarned, however, that the amount of blank space can exceed the height of the screen: it can be disconcerting to run the macro and have all your text apparently disappear into nowhere!

Also be aware that you can designate a blank space in *Word* 4.0 with the simple command

```
.P. ,<height><endmark>
```

This is normally used for printing graphics files, but if you leave out the filename, *Word* inserts a blank space. Note that the `.P.` must be at the beginning of the paragraph and that height should include a measurement symbol after the number—for example, 3.5" to designate 3.5 inches. The endmark will normally be a paragraph mark, although it can be a semicolon or division mark. Unfortunately, for the `.P.` command to work, it must be formatted as hidden text, which may make it hard to find and change if you normally set hidden text not to show.

Word 5.0 will not recognize the `.P.` command. Its equivalent command for printing graphics is

```
.G.;;<height>
```

Unlike the `.P.` command in *Word* 4.0, entering the `.G.` command without a filename yields a "Cannot find graphic" message when printing. However, the message can safely be ignored. Mr. Wall's macro will work in either *Word* 4.0 or 5.0.—*M. David Stone*

- SIZING INSERTS: A Word macro that allots the right space for figures in camera-ready copy.
- CLIPPER'S SET ESCAPE OFF COMMAND: New version alters the function of an old command.
- BACKING UP LARGE DATABASE FILES: Here's a way to back up oversize Clipper files onto floppy disks.
- DRAWING VERTICAL LINES AND GRIDS: WordPerfect's Copy Rectangle function helps you build grids and draw vertical lines.

CLIPPER'S SET ESCAPE OFF COMMAND

In the old, Autumn '86 *Clipper*, issuing the SET ESCAPE OFF command also turned off the processing of the Alt-C keystroke that terminates the program. We used this feature frequently for procedures in which we didn't want an operator to be able to abort. When we recompiled the program with the Summer '87 version, however, we found that Alt-C remained active after SET ESCAPE OFF.

Once we located the problem, the solution was simple. To stop the Alt-C function from aborting, just issue the command SETCANCEL(.F.).

John William Beckner
Lumberton, North Carolina

PC MAGAZINE The SET ESCAPE OFF command has disabled *Clipper*'s Alt-C escape hatch in the past. *Clipper*'s generally superb manual doesn't mention the change in the SET ESCAPE OFF section, though the new SETCANCEL() function is clearly described.—*Brad Stark*

BACKING UP LARGE DATABASE FILES

Danny Case's HD2FLOPY.PRG (Power User, November 15, 1988) is very useful for backing up large files in *dBASE III*, but I can't make it work in *Clipper*.

Addison Simms
Seattle, Washington

PC MAGAZINE *Clipper*'s DISKSPACE function differs from *dBASE* in two ways: it allows the drive to be passed as an optional parameter, and it ignores the SET DEFAULT TO command if no parameter is passed.

Figure 1 lists the modified code for *Clipper* users (it won't run in *dBASE III* or *FoxBASE Plus*). The drive parameter must be a numeric value where A:Drive is 1 and B:Drive is 2. The memory variable, `fdriven`, is created for this purpose by subtracting 64 from the ASCII value of the drive letter you enter @ 3,0.

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MODIFIED HD2FLOPY.PRG 1 of 2

```
*** HD2FLOPY.PRG
CLEAR
odbf=SPACE(30)
fdrive="A"
ndbf=SPACE(8)
@ 1,0 SAY "Backup which database?" GET odbf
@ 3,0 SAY "To which floppy drive?" GET fdrive
@ 5,0 SAY "Enter Backup filename:" GET ndbf
READ
odbf=TRIM(odbf)
ndbf=TRIM(ndbf)
fmess="Insert a blank, formatted disk in ";
     +"Drive &fdrive, and press a key..."
IF READKEY()=12
  RETURN
ENDIF
IF ndbf<=" "
  ? [No TARGET file]+CHR(7)
  RETURN
ENDIF
IF FILE(odbf) .OR. FILE(odbf+".DBF")
  USE &odbf
ELSE
  ? [No SOURCE file: "&odbf"]+CHR(7)
  RETURN
ENDI

fdriven=ASC(UPPE(fdrive))-64
DO WHILE DISKSPACE(fdriven)<1
  WAIT fmess
ENDDO

* Calc header size
STOR 0 TO fldno,header
DO WHILE ""<FIELD(fldno+1)
  fldno=fldno+1
ENDDO
header=32*fldno+35

* Calc # of floppies needed
floprecs=INT((DISKSPACE(fdriven)-header)/RECSIZE())
flopneed=INT((RECCOUNT())/floprecs)+1
makeflop="F"
DO WHILE makeflop$"Ff"
  ? STR(flopneed)+" Disks required.  "
  ?? "Press <ENTER> to proceed."
  WAIT "To format additional disks, insert ";
      +"floppy and press <F>" TO makeflop
  IF makeflop$"Ff"
    RUN FORMAT &fdrive:
  ENDIF
ENDDO

sofar="0"
DO WHILE .NOT. EOF()
  sofar=LTRIM(STR(VAL(sofar)+1))
  COPY NEXT floprecs TO &fdrive:&ndbf..&sofar
```

Figure 1: This *Clipper* program lets you back up large databases onto floppy disks. A similar program for *dBASE III* and *FoxBASE Plus* appeared in Power User, November 15, 1988.

MODIFIED HD2FLOPY.PRG 2 of 2

```
    IF .NOT. EOF()
      SKIP
      DO WHILE DISKSPACE(fdriven)<RECSIZE()+header
        WAIT fmess
      ENDDO
    ENDIF
  ENDDO
```

Readers should also note that HD2FLOPY.PRG will not work with databases that contain memo fields. This is because there is no way to predict how much of the memo text belongs to each block of records being backed up.—*Brad Stark*

DRAWING VERTICAL LINES AND GRIDS

The line-drawing macro for *WordPerfect*, Version 4.2, in the June 14, 1988, Power User column is helpful, but it applies only to horizontal lines. I've found that vertical lines are the really slow ones to draw, especially if you have an ancient, 8088-based machine.

There is a way to beat this problem, however. A quicker and easier method for creating vertical lines is to cut and paste rectangular blocks of text. First, draw a vertical line using the line-drawing feature <Ctrl-F3>2. Then return to normal editing and copy the vertical line, using the following sequence of steps:

- Cursor to the top of the line
- Alt-F4 to turn the block on
- Cursor to the bottom of the line plus one space to the right (so the whole line is highlighted)
- Ctrl-F4; choose option 5, Cut/Copy Rectangle, and option 2, Copy
- Cursor to the top of the location where you want to duplicate the line
- <Ctrl-F4>6 to duplicate the line

The same process will also work with horizontal lines.

David Piehler
Wausau, Wisconsin

PC MAGAZINE The instructions above apply to *WordPerfect*, Version 4.2. In Version 5.0 the sequence of events after the third step would be as follows:

- Press Ctrl-F4; choose option 3, Rectangle, and option 2, Copy
- Cursor to the top of the location where you want to duplicate the line
- Press Enter to duplicate the line

If you use this method to create a large grid, you'll probably want to create a "building block" that includes one full-grid column. Put a vertical line down one side and extend the horizontal crosspieces out to the width of the column, like this:

Copy this rectangle for each column, then clean up the corners in line-drawing mode. —*Neil J. Rubenking*

PC MAGAZINE

PRODUCTIVITY TIP

Clipper's RENAME command can fail disastrously if the filename that you are renaming already exists. You are not asked "Overwrite?", your source file is not RENAMEd, and you get no error message.

You might, typically, RENAME MYFILE.DBF TO TEMP, USE &TEMP, and then SORT TO MYFILE. If a file called TEMP.DBF already exists, the wrong TEMP.DBF will be SORTed.

The solution is always to issue the ERASE command before the RENAME. If there's no file to ERASE, *Clipper* ignores the command; the RENAME will succeed either way.

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Languages

USING BASIC'S INSTR

I have found BASIC's INSTR to be a very powerful aid for processing user input. Normally, asking even a simple Yes or No question requires testing as many as eight possibilities. For example, if a program asks "Direct output to the printer?" the user could respond with Y, y, YES, yes, N, n, NO, or no. Since most programs usually need to know only if the answer is yes, the entire process can be reduced to this simple test:

```
IF INSTR("YESyes", Answer$)
THEN...
```

After all, when working with BASIC, simplicity is the goal, right?

Bill Dempsey
Hoffman Estates, Illinois

PC MAGAZINE Right you are! The true purpose of INSTR is to report where one string occurs within another string. However, it is also useful for determining if a given substring is present at all. INSTR is equally valuable when more than two choices are possible, such as when case-sensitive and case-insensitive letters are paired. With, say, five choices whose first letters are O, C, A, B, and F, you could use INSTR to convert the selected letter into an equivalent choice number. In the example below, O or o would equal choice 1, C or c would be choice 2, etc.

```
Choice = (INSTR("OoCcAaBbFf",
Answer$) + 1) / 2
```

—Ethan Winer

USE BIT ARRAYS TO DEFINE FLAGS

I began programming on a Hewlett-Packard programmable calculator and learned to depend on its built-in "flag" function—a means of setting yes/no variables that can be set and later tested by a program as it runs. Because flags occupy only a single bit of memory, they can go a long way toward preserving data space in a BASIC program, especially when compared with an equivalent number of integer variables. In the case presented here, the program, FLAGS.ASM, shown in Figure 1 is limited to 64 separate flag variables, but this can be very easily expanded by modifying the assembly-language source code.

Thomas C. Burnside
North Bend, Washington

PC MAGAZINE In those situations when a simple true or false variable is all that is needed, it's a shame to use an integer that occupies 2 bytes (16 bits). QuickBASIC allows only arrays, constants, and DATA items. In addition, QuickBASIC itself takes another 10K or so for its own work variables such as the current color and DEF SEG settings. By placing the flag bytes in the routine's code segment, Mr. Burnside has prevented any "near" memory from being wasted.

As originally submitted, the FLAGS

- **USING BASIC'S INSTR:** Use BASIC's INSTR function to simplify validating user responses.
- **USE BIT ARRAYS TO DEFINE FLAGS:** QuickBASIC bit arrays will save memory by using the smallest data type possible.
- **NUMBERING COLUMNS ALPHABETICALLY:** These clever Turbo Pascal routines number columns alphabetically, the way a spreadsheet does.

FLAGS.ASM 1 of 2

AVAILABLE ON PC MAGNET

```
;********** FLAGS.ASM

;Syntax: CALL ClearAll                'clear all flags
;        CALL ClearFlag(FlagNum%)     'clear flag number FlagNum%
;        CALL SetFlag(FlagNum%)       'set flag number FlagNum%
;        Flag = GetFlag%(FlagNum%)    'retrieve flag number FlagNum%

.Model Medium, Basic
.Code

    Public ClearAll, ClearFlag, SetFlag, GetFlag

ClearAll Proc Far
     Push CS                         ;copy the code segment into ES
     Pop  ES
     Mov  DI,Offset CS:Flags         ;point DI to the flag words
     Mov  CX,4                       ;clear 4 words
     Xor  AX,AX                      ;set AX = 0
     Rep  Stosw                      ;store 4 zero words
     Ret                             ;return to BASIC
ClearAll Endp

ClearFlag Proc Far
     Push BP                         ;set BP to incoming variable
     Mov  BP,SP
     Mov  SI,[BP+06]                 ;get the address for FlagNum%
     Call DoFlag                     ;let DoFlag handle the common code
```

Figure 1: Incorporate these assembler routines into your QuickBASIC programs and save memory. Using "flag" variables that require only 1 bit of memory, rather than an integer that requires 2 bytes, goes a long way toward preserving a BASIC program's precious data space.

FLAGS.ASM 2 of 2

```
     Jc   ExitClear              ;if carry is set, FlagNum% was illegal
     Not  AL                     ;reverse to clear the flag
     And  CS:Flags [BX],AL       ;set the appropriate Flag bit

ExitClear:
     Pop  BP                     ;restore BP
     Ret  2                      ;return to BASIC
ClearFlag Endp

SetFlag Proc Far
     Push BP                     ;set BP to incoming variable
     Mov  BP,SP
     Mov  SI,[BP+06]             ;get the address for FlagNum%
     Call DoFlag                 ;let DoFlag do the work
     Jc   ExitSet                ;if carry is set, FlagNum% was illegal
     Or   CS:Flags [BX],AL       ;set the appropriate Flag bit

ExitSet:
     Pop  BP                     ;restore BP
     Ret  2                      ;return to BASIC
SetFlag Endp

GetFlag Proc Far
     Push BP                     ;set BP to incoming variable
     Mov  BP,SP
     Mov  SI,[BP+06]             ;get the address for FlagNum%
     Call DoFlag                 ;let DoFlag worry about it
     Test CS:Flags [BX],AL       ;see if the bit is set
     Mov  AX,0                   ;assume it isn't
     Jz   ExitGet                ;we were right
     Dec  AX                     ;no, assign -1 for the function output

ExitGet:
     Pop  BP                     ;restore BP
     Ret  2                      ;return to BASIC
GetFlag Endp

DoFlag Proc Near                 ;common code for the other routines
     Mov  AX,[SI]                ;put FlagNum% into AX
     Dec  AX                     ;adjust 1-64 to 0-63
     Cmp  AX,63                  ;see if it's too high
     Ja   DoError                ;it is, get out

     Push AX                     ;save AX for later
     Mov  CX,8                   ;divide by eight
     Xor  DX,DX                  ;clear DX for the divide
     Div  CX                     ;now AX points to the correct flag word
     Mov  BX,AX                  ;transfer to BX for an index

     Mov  AL,1                   ;make a bit
     Pop  CX                     ;retrieve the flag number
     Rol  AL,CL                  ;now the bit is in position
     Clc                         ;clear the carry to show no error
     Ret                         ;return to caller

DoError:
     Stc                         ;set the carry to show an error
     Ret                         ;return to caller
DoFlag Endp

     Flags   DB 8 Dup (0)        ;this holds the flags

End
```

FLAGS.BAS 1 of 2

```
'********** FLAGS.BAS

DEFINT A-Z
DECLARE SUB ClearAll ()                 'clears all flags
DECLARE SUB ClearFlag (FlagNum)         'clears a single flag
DECLARE SUB SetFlag (FlagNum)           'sets a single flag
DECLARE FUNCTION GetFlag% (FlagNum)     'retrieves a single flag
```

Figure 2: This QuickBASIC program demonstrates the use of bit "flag" variables and lets you test a flag's status with BASIC's NOT feature. The flag variables occupy significantly less memory when compared with other variable types such as integers.

.ASM program (Figure 1) contained seven separate procedures. I reduced these procedures down to four essential routines—one to clear all flags to zero, one to clear a single flag, another to set a single flag, and one more to retrieve a flag. In addition, I reorganized the routines slightly in the interest of clarity.

Unlike the three called routines that assign flags, GetFlag has been designed as a QuickBASIC 4 function. That is, it may be incorporated into a BASIC PRINT or assignment statement. Because GetFlag is a function, however, it must be declared before it may be used. The FLAGS.BAS example program in Figure 2 allows optionally testing a flag's status using BASIC's NOT feature. For example:

Unlike the three called routines that assign flags, GetFlag has been designed as a QuickBASIC 4 function. It may be incorporated into a BASIC PRINT or assignment statement.

```
IF Flag%(X%) THEN ...  'flag
  set-do something
```

or

```
IF NOT Flag%(X%) THEN ...
  'flag clear-do something
```

In order to incorporate the routines in a QuickBASIC program, you must assemble the FLAGS.ASM file using either Microsoft MASM 5.0 or later or a compatible assembler. Then, use LINK as described in the QuickBASIC manuals to create a Quick Library for use in the editing environment. To create a final .EXE program, you would instead link FLAGS

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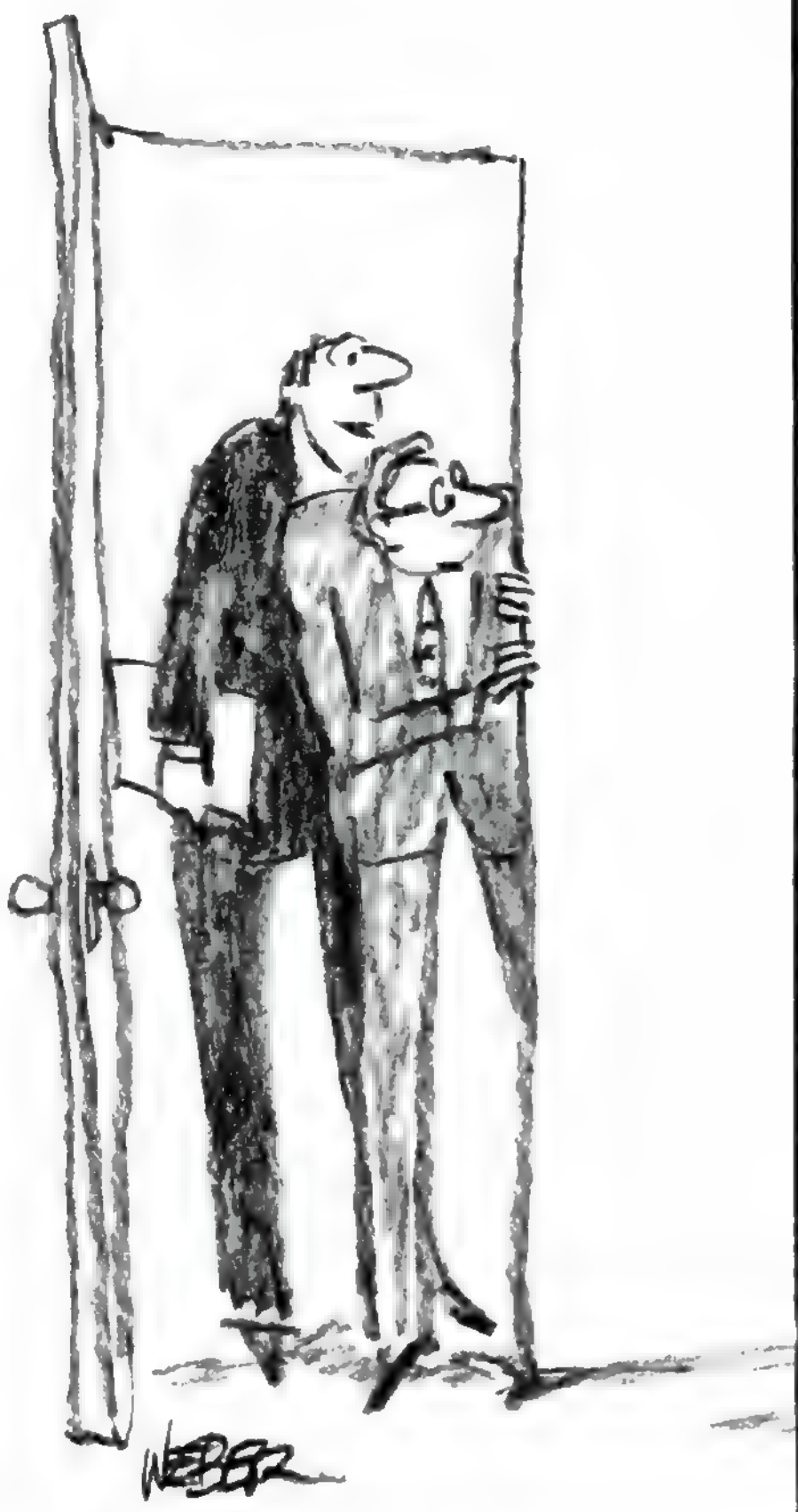

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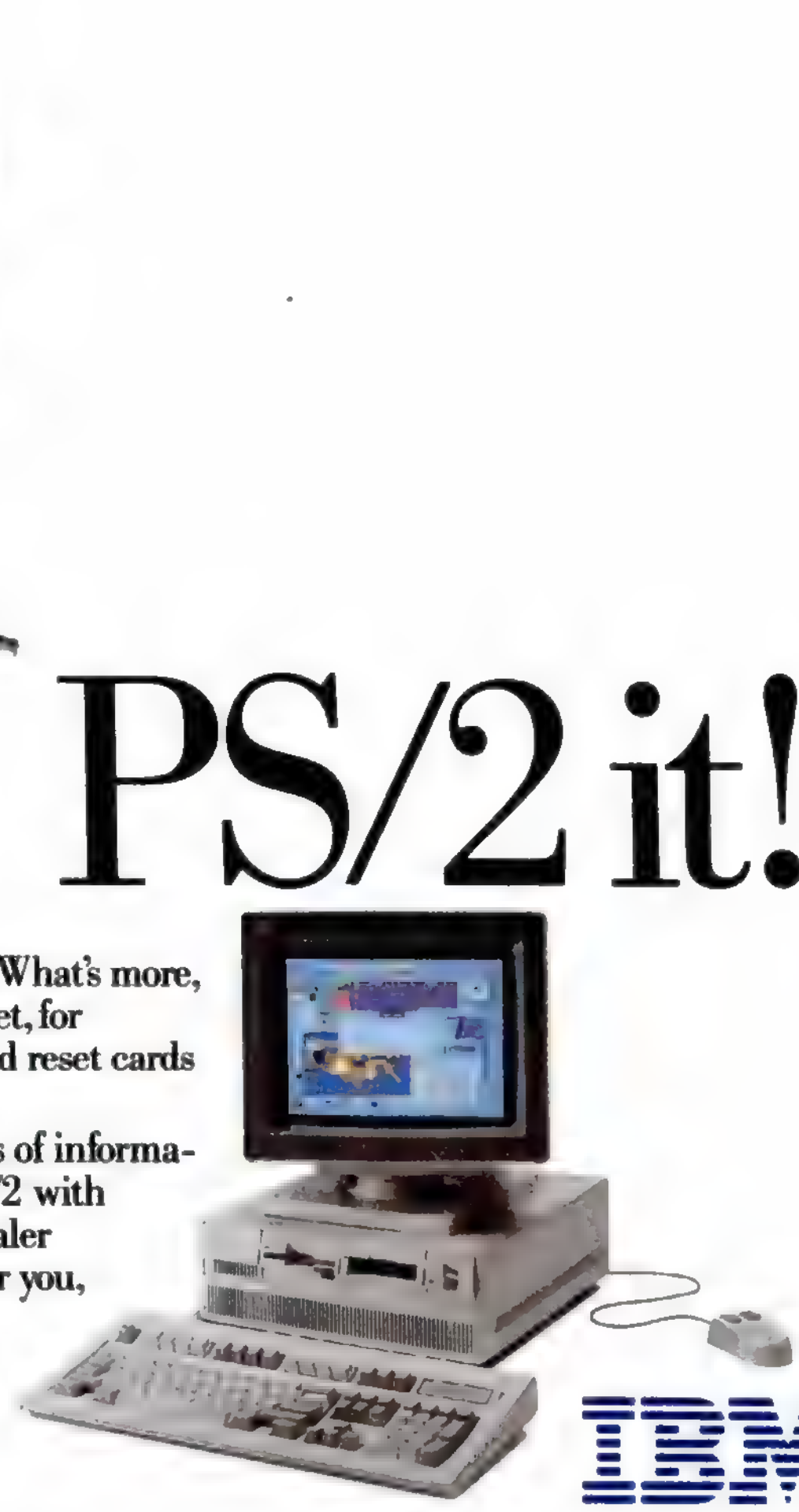

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FLAGS.BAS 2 of 2

```
CLS
ClearAll                        'clear all the flags

FOR X = 1 TO 64                 'display each flag to prove they're zero
    PRINT GetFlag%(X);
NEXT
PRINT : PRINT

FOR X = 1 TO 64                 'set all of the flags
    SetFlag X
NEXT

FOR X = 1 TO 64                 'display each flag again
    PRINT GetFlag%(X);
NEXT
PRINT : PRINT

FOR X = 1 TO 64 STEP 2          'clear every other flag
    ClearFlag X
NEXT

FOR X = 1 TO 64                 'prove that it worked
    PRINT GetFlag%(X);
NEXT
```

.OBJ to your compiled BASIC program using the following statement:

```
LINK basicprogram + flags;
```

—Ethan Winer

PRODUCTIVITY TIP

Any Turbo Pascal 5.0 program can use the IEEE data types to get extreme accuracy in large numbers. Use the COMP type, which is effectively an 8-byte integer. In currency calculations, keep track of the exact number of pennies and write a routine to display these amounts as dollars and cents. This will let you track dollar amounts greater than $90,000,000,000,000,000.00!

NUMBERING COLUMNS ALPHABETICALLY

One problem in switching between numbering systems where the base of one is not a multiple of the base of the other (for example, from base 10 to base 26) is displaying the numbers with properly carried places. Properly formatting column labels can also be a problem when leading zeros or blanks are used. One way to work around this problem is to use a separate counter for each place, but this is rather cumbersome.

This particular routine will work for columns A through ZZ without skipping a beat. Simply pass a positive integer value to the Alpha routine, and it returns a properly formatted column label. Moreover, it's really quite simple. The routine requires only one line of code, yet it handles 702 columns—more than most people are ever likely to need! The Numeric function is almost as simple: it returns the integer value

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ALPHACOL.PAS — **COMPLETE LISTING**

```
PROGRAM AlphaCol;
(*Translate integers to and from alphabetic
  column headings.  Integers from 0 to 701,
  headings from " A" to "ZZ"*)

TYPE AString = STRING[2];

VAR i : Integer;

  FUNCTION Alpha(i : Integer) : AString;
  CONST digits : ARRAY[0..26] OF Char = ' ABCDEFGHIJKLMNOPQRSTUVWXYZ';
  BEGIN
    Alpha := digits[i DIV 26] + digits[Succ(i MOD 26)];
  END;

  FUNCTION Numeric(AlStg : AString) : Integer;
  BEGIN
    IF AlStg[1] = ' ' THEN
      Numeric := (Ord(AlStg[2])-65)
    ELSE
      Numeric := ((Ord(AlStg[1])-64)*26) + (Ord(AlStg[2])-65);
  END;

BEGIN                                {Demo}
  FOR i := 0 TO 701 DO
    BEGIN
      Write('Column is "', Alpha(i), '"');
      WriteLn('  Column value is ', Numeric(Alpha(i)), '.');
    END;
END.
```

Figure 3: Routines to manage spreadsheet-style column headings.

of a two-character string passed to it.

The Alpha routine works because the units index skips over the blank in the digits array. A zero is never a possible solution of the MOD expression (the Succ function ensures that) so the blank in the digits array is never indexed. However, since the tens column expression can resolve to zero, leading blanks are possible.

Alpha requires only one line of code, yet it handles 702 columns—more than most people are ever likely to need!

One nice thing about these routines is that internally, columns remain as integers, making column arithmetic and array indexing a snap!

Dale Coons
Pittsburgh, Pennsylvania

PC MAGAZINE Good things come in small packages. The two routines in this program, Alpha and Numeric, which are shown in Figure 3, look simple, but they'll be invaluable if you're writing a spreadsheet or spreadsheet-like display.
—Neil J. Rubenking

PC MAGAZINE **PRODUCTIVITY TIP**

In any version of Turbo Pascal, you're limited to one 64K data segment. You can declare large data items on the Heap, of course, but you have to allocate memory for each with New or GetMem. Instead, try declaring one big procedure that includes your whole program. Variables declared inside this procedure will be effectively global, but they'll use the Stack instead of the DSeg.

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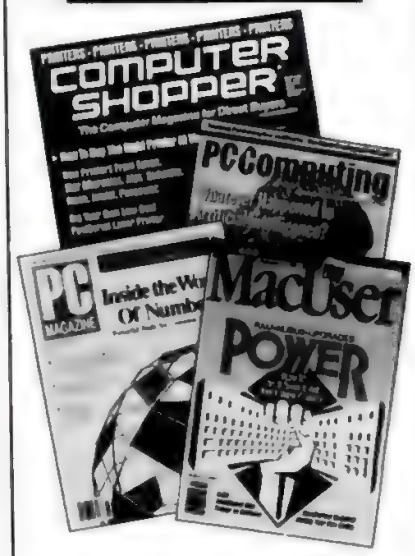

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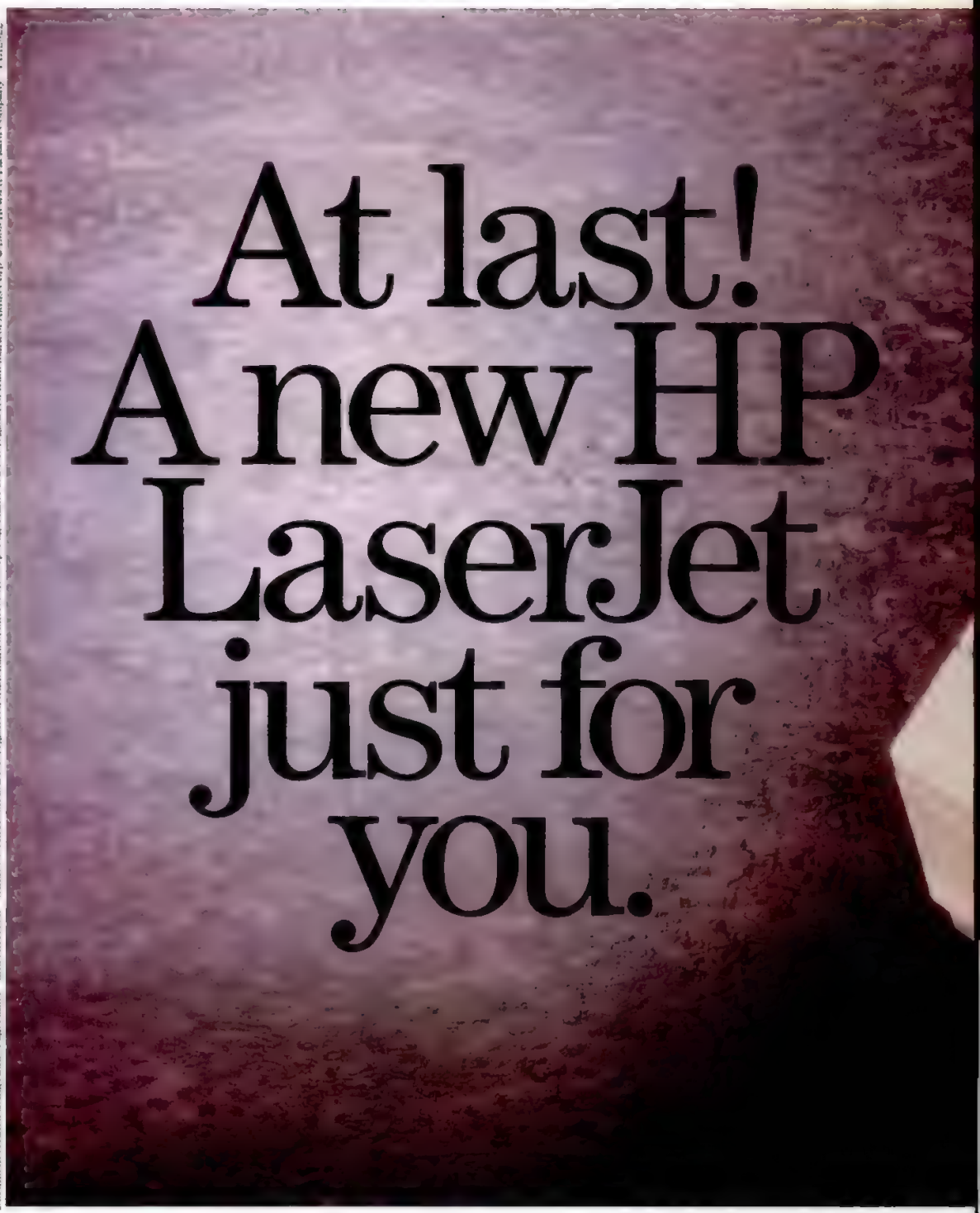

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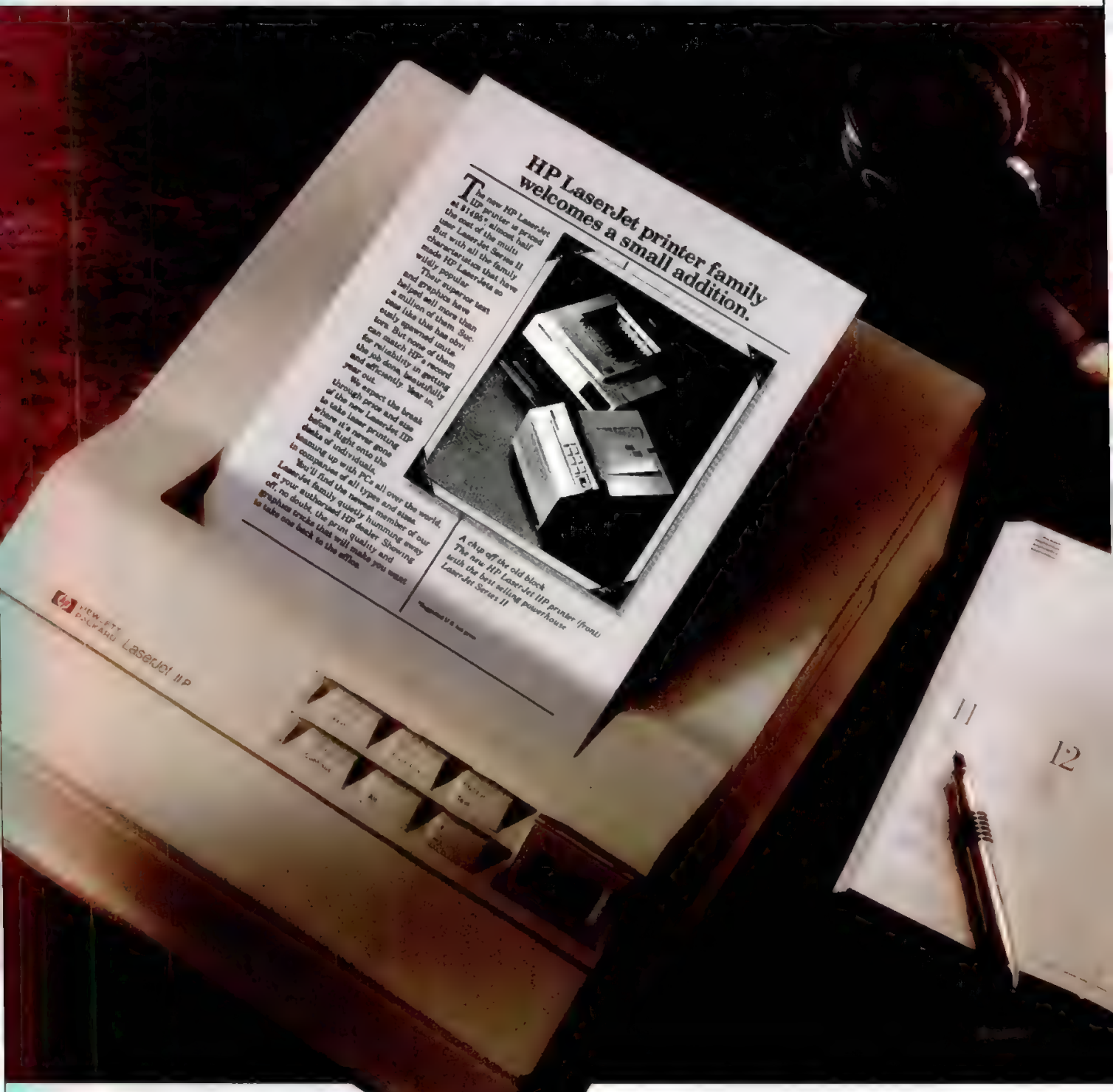

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Connectivity Clinic

BRIDGING THE GAP

Is there any easy way to hook a Toshiba laptop (with no expansion slot) to a Novell Ethernet LAN? Removing the modem is too difficult, so using that slot is no solution.

Bill Murphy
Atlanta, Georgia

PC MAGAZINE A lot depends on what you mean by "hooking" to a LAN. If you just want to move files between your laptop and the LAN, the easiest method is through file transfer programs such as *Lap-Link Plus*, *The Brooklyn Bridge*, or *LAN-Link Laptop*. Many of these packages include the cable needed for connecting your laptop to a PC.

If you load one of these products onto a machine that is logged onto the network, the software can access the network drives. This kind of file transfer ties up a machine on the network, but the connection is easy to make and it works well.

For further information, check the April 25, 1989, issue of *PC Magazine* for reviews of seven software transfer products ("File Transfer Software: Building Bridges Between Machines").

MIX AND MATCH

We just want to check one more time before we spend our money. Your review of Ethernet cards in the January 31, 1989, issue ("Building Workgroup Solutions: Ethernet Cards") seemed to indicate that we can mix cards from different companies on the same network cable and that they will all work together. Is that correct?

Dennis Simpson
Chicago, Illinois

PC MAGAZINE That's right! You can mix Ethernet adapters from 3Com, Gateway, Western Digital, and other companies on the same cable and they will all intercommunicate. The catch, however, is that you must have the proper driver module in your networking software to support each type of card. Some LAN software companies, such as Novell, Banyan, and CBIS, provide drivers for cards from many different manufacturers. And many card manufacturers provide the drivers for their products under *NetWare*. Some, like Western Digital, also provide an implementation of NetBIOS with their cards so that you can run LAN software such as Artisoft's *LANtastic* or IBM's *PC LAN*.

There is one caveat, however: Make sure users don't exchange software drivers if different types of boards are installed in their machines. Document the specific kind of driver each one uses, including the exact size of each file. Sometimes size is the only way you can tell the files apart.

This same mix-and-match capability is available in ARCnet and Token-Ring adapters, too. If you manage a Token-Ring network, you could benefit by taking advantage of the current price war among manufacturers of Token-Ring cards. You can safely mix cards from IBM, Proteon, 3Com, Madge, and Racore on the same Token-Ring network. Some of these cards sell for 30 percent of IBM's retail price.

- BRIDGING THE GAP: Data transfer packages make it easy to move files between a laptop and a LAN.
- MIX AND MATCH: Ethernet cards from various companies can work together on the same network.
- HANDLING LOG-IN SCRIPTS: How to make sure users log onto the correct server.
- CLARIFYING TERMS: It's time to standardize the terms used in remote-access communications.

HANDLING LOG-IN SCRIPTS

Here is a little trick that makes life easier on Novell networks where users need to access multiple servers. Let's assume that servers FS1, FS2, and FS3 are on the network and that users' log-in scripts are centralized on server FS1 for easier maintenance.

Users normally log onto the network by entering

```
login username
```

However, logging onto FS2 or FS3 using this syntax can cause problems. Since the log-in does not occur on FS1, the log-in script is bypassed. This means that drive mapping might not be set up and other start-up batch files might not execute.

If, however, the administrator puts the command

```
#login FS1/%LOGIN_NAME
```

into the system log-in scripts for the other servers, then anyone inadvertently logging onto FS2 or FS3 will be rerouted to FS1. This technique is independent of the log-in name, so you don't have to add this command to user scripts.

George P. Milliken
Sacramento, California

PC MAGAZINE Handling log-in scripts on multiple Novell servers can be a cumbersome administrative chore. Remember that the server making the first attachment will be the one with the fastest response time for that workstation. Some administrators of multiserver networks intentionally keep one server small and fast to handle administrative tasks.

CLARIFYING TERMS

Vendors of remote-control packages for PCs use many different terms to describe the remote or controlling computer and the host or controlled computer. A casual roundup of existing products yields the array of names in Figure 1.

Connectivity Clinic

Any discussion of remote-access sessions becomes confusing, because the participating machines change their names as they change tasks. The traditional understanding of a host as a central, dominant (mainframe) computer is at odds with the current definition, in which a host is subordinate to its remote counterpart. Adding to the confusion is the notion that the connection called "remote" might be either the local computer sitting on your desk or one at some very distant location.

Users need a commonsense set of names for such products. How about playing umpire?

Polly Henderson
Baton Rouge, Louisiana

This situation has become even more important because many programs providing remote control across a LAN have entered the market. On a network, the terms *host* and *remote* are already used, and perhaps overused.

The terms *controller* and *controlled* are descriptive, but *controller* means special things in LAN SNA gateways. I propose using the terms *controlled computer* and *controlling computer* as standard. These terms hold their meaning over RS-232 connections as well as over LANs.

REMOTE-ACCESS COMMUNICATIONS TERMS

Product	Remote (Controlling computer)	Host (Controlled computer)
Carbon Copy	CC	CCHelp
Close-Up	Support/ACS	Customer/Terminal
Co/Session	Support	Application
PC Anywhere	ATerm	Anywhere
Remote 2	R2Call	R2Host

Figure 1: The numerous terms used to describe communications functions are often confusing.

PRODUCTIVITY TIP

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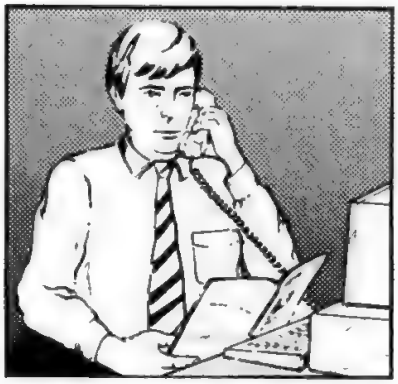

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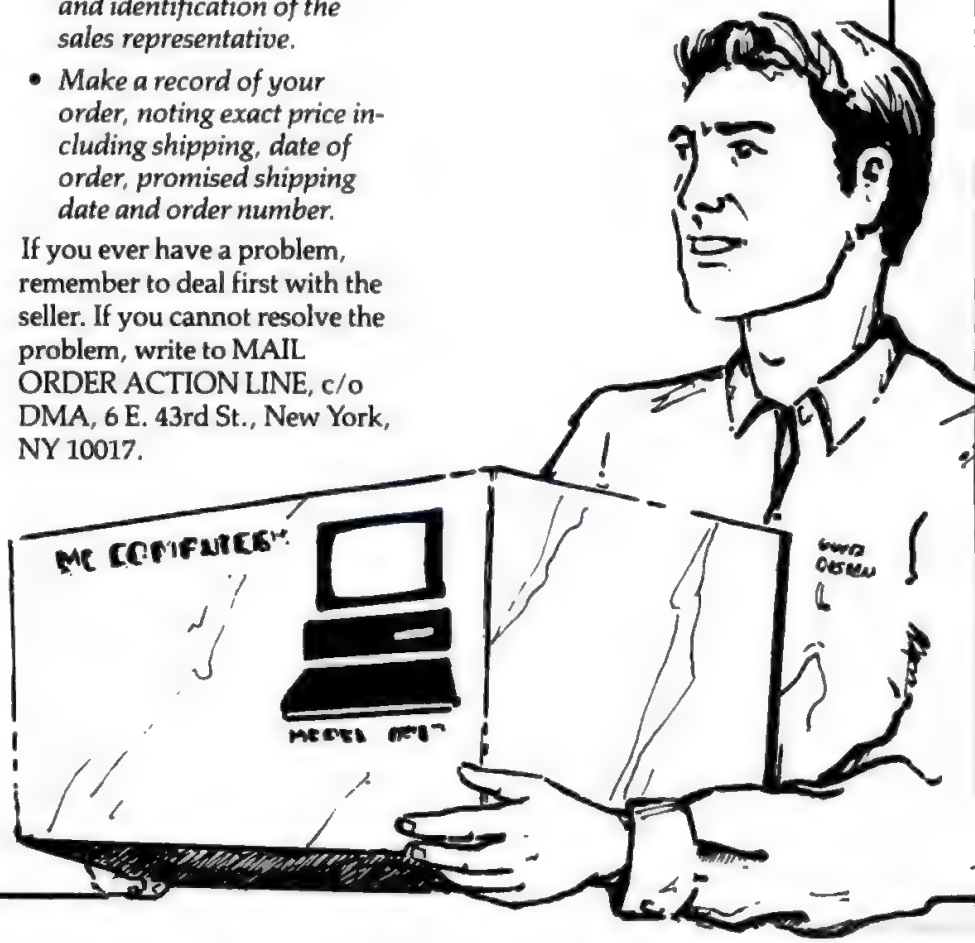

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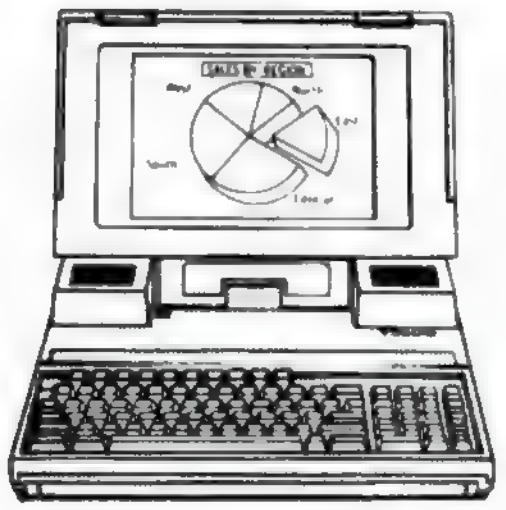

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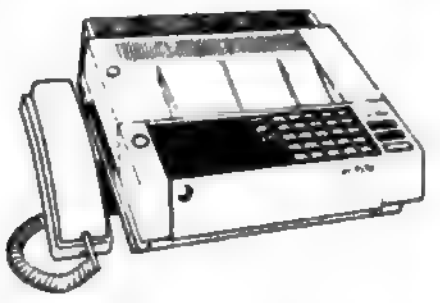

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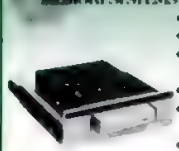

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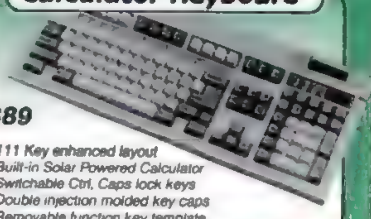

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- 111 Key enhanced layout
- Built-in Solar Powered Calculator
- Switchable Ctrl, Caps lock keys
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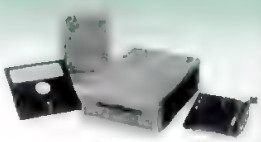
***FREE: TakeTwo,** the floppy backup utility PC MAGAZINE names as their Editor's Choice. Now you have a fast, affordable backup solution that brings you media compatibility with the latest IBM PS/2 systems.*



720K Internal for PC/XT/AT. **$99**
- Requires DOS 3.2 or optional $15 driver software

1.44MB Internal for AT only. **$109**
- Includes driver software.

1.44MB Internal for PC/XT. **$199**
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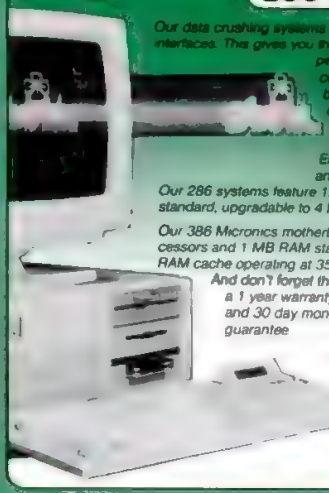
HH	ST277R	40ms	RLL	65MB	$449
FH	ST4096	28ms	MFM	80MB	$599

286 and 386 Computers



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Seagate ST277N 65 meg 40 ms	$469
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*Each kit includes high speed SCSI hard drive with face plate, host adapter, installation guide with menu driven software, and mounting hardware. Bundled software includes the **TakeTwo** backup utility, and **Lprecache** disk cache software. Specify computer when ordering.*

Seagate Model	Size	Formatted Capacity	Average Access	Kit Price
ST225N	5.25"	20MB	65 msec.	$329
ST138N	3.5"	30MB	40 msec.	$369
ST157N	3.5"	49MB	40 msec.	$389
ST277N	5.25"	64MB	40 msec.	$499
ST296N	5.25"	80MB	28 msec.	$559

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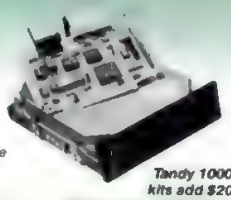

Tandy 1000 kits add $20

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- Includes speaker
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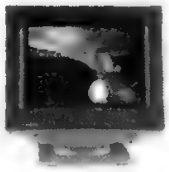

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ST138N	30Mb	3.5"HH	40ms	SCSI	$349.95	----------	----------
ST157N	40Mb	3.5"HH	40ms	SCSI	$399.95	----------	----------
ST125	20Mb	3.5"HH	40ms	MFM	$259.95	----------	----------
ST138R	30Mb	3.5"HH	40ms	RLL	$289.95	----------	----------
ST157R	40Mb	3.5"HH	40ms	RLL	$379.95	----------	----------
ST225	20Mb	5.25"HH	65ms	MFM	$224.95	----------	----------
ST225XT	20Mb	5.25"HH	65ms	MFM	----------	$269.95	----------
ST225AT	20Mb	5.25"HH	65ms	MFM	----------	----------	$339.95
ST238	30Mb	5.25"HH	65ms	RLL	$249.95	----------	----------
ST238XT	30Mb	5.25"HH	65ms	RLL	----------	$299.95	----------
ST238AT	30Mb	5.25"HH	65ms	RLL	----------	----------	$389.95
ST251	40Mb	5.25"HH	40ms	MFM	$379.95	----------	----------
ST251XT	40Mb	5.25"HH	40ms	MFM	----------	$419.95	----------
ST251AT	40Mb	5.25"HH	40ms	MFM	----------	----------	$489.95
ST251-1	40Mb	5.25"HH	28ms	MFM	$469.95	----------	----------
ST277	60Mb	5.25"HH	40ms	RLL	$409.95	----------	----------
ST277XT	60Mb	5.25"HH	40ms	RLL	----------	$449.95	----------
ST277AT	60Mb	5.25"HH	40ms	RLL	----------	----------	$549.95
ST4096	80Mb	5.25"FH	28ms	MFM	$629.95	----------	----------
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ST157N

ST225XT

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- Gold Plated Female Connectors

JE1170 Pictured

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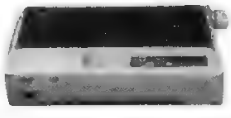

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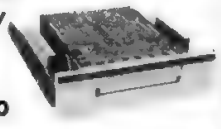

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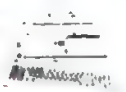

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320 (IBM)	335
390 (IBM)	469
393 (IBM)	999
Panasonic	
KXP1180	175
KXP1191	225
KXP1124	319
KXP1595	425
KXP1524	525
KXP4450	1299
Star	
NX1000	167
NX2400	289
Toshiba	
P321SL	439
P341SL	599
P351SX	929

LAPTOPS

Megahertz Modems	
2400B Most Toshiba	149
2400B NEC, Epson Mitsubishi or Zenith	189
Mitsubishi	Call
NEC MultiSpeed's	Call
Toshiba	
T1000	639
T1000 768k Card	259
T1200F	1349
T1200FB Backlit	1449
T1200HB Backlit	1949
T1600	Call
T5200/100mb	5495

BOARDS

ATI	
2400 ETC Int.	149
VGA Wonder 256	265
VGA Wonder 512	319
Everex	
1200B Int Modem	59
2400B Int Modem	119
VGA 16 bit 256K	249
Genoa	
Super EGA Hi-Res	165
Super VGA #5300	249
Super VGA #5400	319
FastData *(satisfaction gauranteed)*	
2400B Int. Modem	85
CGA or MGP Card	39
Super EGA Card	109
Parallel/Serial/Game Card	39
XT 1.44 Floppy Controller	33
Hercules Graphic Card +	169
Intel	
8087-2	119
80287-10	219
80387-20	379
Orchid	
ProDesigner	269
ProDesigner Plus	369
Tiny Turbo 286	205
Paradise	
Autoswitch 480	159
VGA Plus	219
VGA Plus 16	239
VGA Professional	359
Practical Peripherals	
1200B Int Modem	59
2400B Int Modem	129
Prometheus	
Promodem 1200B Int.	49
Promodem 2400B Int.	99
Promodem 2400G Ext.	88
The Complete PC	
Answering Machine	209
Hand Scanner 400	139
USRobotics	
1200 Baud Internal	69
2400 Baud Internal	119
2400 Baud External	149
Video 7	
Fast Write VGA	237
Vega Deluxe	189
Vega VGA	219
V-RAM VGA	369

MONITORS

Magnavox	
7BM749 VGA White	129
9CM082 VGA	419
Mitsubishi	
1410 EGA	325
Diamond Scan 1381	479
NEC	
Multisync 2a	489
Multisync 3d	645
Princeton	
Max15	237
Ultrasync 12"	479
Ultrasync 14"	519
Ultra 16	835
Seiko CM1430	549
Sony	
1302 Multiscan	659
1304 Multiscan	Call
Zenith 1490	595

DISK DRIVES

Colorado	
Jumbo 40-120mb Int. Tape	269
Miniscribe	
40MB XT Kit #8450	299
40MB AT #3650	259
71MB AT #3085	549
Mitsubishi	
60MB AT MR535	379
Seagate	
20MB XT Kit #225	239
30MB XT Kit #238	249
40MB AT #251-1	319
65MB AT #277R-1	365
80MB AT #296N w/ SCSI Adapt.	499
80MB AT #4096	559
Toshiba	
360K Floppy	69
720K 3.5" Floppy	69
1.2MB 5.25" Floppy	79
1.44MB 3.5" Floppy	79

Call On Non-Listed Items

SOFTWARE

Database

Clipper	399
DataEase	449
dBase IV	439
dBXL Diamond	129
Foxbase Plus	185
Paradox 3.0	419
Q & A	197
RapidFile	179
Rbase for DOS	439
Reflex	159

Desktop Publishing

Byline	175
GEM Desktop Pub.	159
Pagemaker	479
PFS:First Publisher	69
Publisher's Paintbrush	149
Ventura	Call

Financial

Bedford Integr. Acct.	133
Computer Assoc. BPI	Call
DAC 3.0	53
DAC Payroll 3.0	53
Dollars & Sense	Call
Managing Your Money	113
Peachtree Complete II	139

Graphics

Corel Draw	Call
Deluxe Paint II	67
First Graphics	Call
Freelance Plus	329
GEM Artline	269
Generic Cadd Level 3	149
Harvard Graphics	255
Perspective Jr.	69

Integrated

First Choice	Call
Works	89
Windows 286	59
Windows 386	117

Mice

Keytronics Professional	75
Logitech C7 Serial	59
Logitech HiRes C9 Bus	69
Logitech HiRes C9 Serial	75
Microsoft Serial or Bus	94
Microsoft W/ Windows 286	129
OmniMouse Serial	39
PC Mouse II Serial or Bus	79

Power Protection

Curtis Ruby Plus	59
Datasheild 100	57

Programming

Macro Assembler	89
Norton Guides (Specify)	58
Turbo Assembler/Debugger	87
Turbo Basic	60
Turbo C 2.0	90
Turbo Pascal 5.0	90
Quick Basic	60
Quick C	60
Quick Pascal	60

Spreadsheets

Allways	79
Excel	Call
Lotus	Call
Lucid 3-D	53
Quattro	145

Utilities

CoreFast	60
Carbon Copy Plus	104
Desklink	95
Desqview	68
Desqview 386	99
Direct Access	46
Fastback Plus	97
Formtool	54
Formfiller	85
Laplink Plus	59
Laplink III	75
MS-Dos 4.01	79
Mace Utilities	53
Norton Advanced	79
PC Tools Deluxe	Call
ProComm Plus	42
SideKick Plus	119
Sideways	37
Super PC Kwik	43
XTree Pro	67

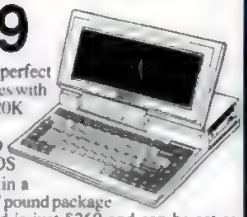
Word Processors

Ami	Call
GEM First Word Plus	57
Grammatik III	49
Manuscript	Call
Multimate Adv. II	267
Professional Write	125
Rightwriter	45
Sprint	117
Q & A Write	109
Word 5.0	Call
Word Perfect	215
Word Perfect Library	59
WordStar Prof. 5.5	189

SPECIALS

Toshiba T1000

$639



The T1000 is the perfect second PC! It comes with 512K of Ram, a 720K floppy drive, a supertwist LCD screen and MS-DOS in ROM! All this in a battery-powered 7 pound package. A 768K Ram card is just $269 and can be set as base, expanded, or a non-volitile Ram disk.

WordPerfect 5.0

$215

The most popular word processor is now even better than ever! Version 5.0 adds multiple font support, graphics integration, page preview and much more. WordPerfect 5.0 still retains its feel and ease of use that made it #1. Combine this with the best support in the industry and you can't lose.

FoxBASE+

$185

FoxBase+ 2.10 is simply the fastest dBASE compatible database software available. FoxBase+ also adds many enhancements to the dBASE language. And it's user-friendly too, its FoxCentral uses pull-down and pop-up menus and you can perform every important database operation without programming! There are even LAN, runtime, and 386 versions available.

FastWrite VGA

by Video Seven

$237

The FastWrite is the fast solution for today's high resolution monitors. Its proprietary technology incorporates high speed data paths to reduce access to memory and sixteen bit connector enhances performance even further. It does a maximum of 800x600 resolution on your multisync-type monitor and is gauranteed VGA hardware AND software compatible.

TERMS: No Charge for Visa or MasterCard. Shipping & handling charge: 3% (Min. $4). Product warranties, offers & claims are handled by the manufacturer. DOA's repaired or replaced at our option. Unopened returns get full refund. All opened returns are subject to 15% restocking fee. FastData products have a 30-day satisfaction gaurantee. Call for return authorization (RA) number first. No returns on used items. Shipping is not refundable. Sorry, no COD's. Personal/company checks delay shipping. Compatibility is not guaranteed. APO's add $15 per box. Prices/availablity subject to change. AZ orders add 6.7% tax. For your protection, we check for stolen credit cards.

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Chosen #1 In Value By Corporate Buyers

Best Buys. With twice the speed of an IBM XT®, the CompuAdd Turbo/10 is a popular choice for home users and small businesses. Its 8088 microprocessor, running at 10MHz, is fully IBM-compatible. And with eight expansion slots you can easily add enhancements such as FAX boards, memory cards and mouse devices. The Turbo/10 comes equipped with a 5.25" 360KB diskette drive, keyboard, and a wide choice of options.

"Its fast performance, low price and superior keyboard make it a solid value." PC World (8/88)

CompuAdd Turbo/10

- 8088 processor running at switchable 10MHz or 4.77MHz speeds
- 640KB RAM
- 5.25" 360KB half-height, dual-sided diskette drive
- Dual diskette drive controller board
- Eight XT-compatible expansion slots
- 8087 math coprocessor support
- Front panel display with keylock, reset button, turbo button, plus LED indicators
- Choice of enhanced 101-key, AT-style, or 5151 keyboard

$545

Turbo/10 System	MGA	EGA	VGA
No Hard Drive	$679	$1,029	$1,149
30MB	$949	$1,299	$1,419

Business Workhorses. The CompuAdd 286/12 is chosen first by value-minded buyers for its solid performance and low price. In a comparison of five "Hot" 80286 bargains by *PC/Computing* (2/89), CompuAdd's speed came out on top. Little wonder. With the CPU running at 12MHz and 0 wait state architecture, the 286/12 is 50% faster than the IBM AT®, with a 13.7 rating on Norton's SI 4.0 test.

"The system combines high speed and a low price for a very good value." Info World (1/25/88)

CompuAdd 286/12

- 80286 processor running at 12MHz or 6MHz switchable system speeds
- 0 wait state
- 512KB RAM expandable to 1MB
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Six 16-bit and two 8-bit expansion slots
- 80287 math coprocessor support
- Choice of enhanced 101-key, AT-style, or 5151 keyboard
- 13.7 on Norton's SI 4.0 test

$945

286/12 System	MGA	EGA	VGA
20MB	$1,299	$1,649	$1,769
40MB	$1,499	$1,849	$1,969

90-Day Express Product Exchange

If a problem effects the service or operation of a component purchased as a CompuAdd system (CPU, monitor, or keyboard) in the first 90 days, we will determine the cause and, if needed, ship a replacement part or product within 48 hours (depending on availability of part) via Federal Express® standard air—at our expense.

To Order In The U.S. Call Toll-Free: **800-666-1872**

Customer Support: **800-999-9901**

International: **512-258-5575** FAX: **512-250-5760**

When PC Week asked corporate buyers how satisfied they were with their 286/12MHz computers, CompuAdd was ***number one*** *in value for the price.*

Now in Canada!

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CompuAdd 286/20

- 80286 processor running at 20MHz or 8MHz switchable system speeds
- 0 wait state (four-way interleave)
- 1MB RAM expandable to 5MB
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Eight expansion slots
- Two serial ports and a parallel port built-in
- 80287 math coprocessor support
- Enhanced 101-key keyboard
- 20.4 on Norton's SI 4.0 test (22.5 rating with 2MB memory and four-way interleave)

$1595

286/20 System	MGA	EGA	VGA
40MB	$2,155	$2,505	$2,625
80MB	$2,345	$2,695	$2,815

CompuAdd 386/16

- 80386 processor running at 16MHz or 8MHz
- 0 wait state (page-mode memory)
- 32-bit high speed RAM board
- 1MB RAM expandable to 10MB
- System/option ROM shadowing
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Seven expansion slots
- 80287 math coprocessor support
- Choice of enhanced 101-key, AT-style, or 5151 keyboard
- 17.6 on Norton's SI 4.0 test

$1795

386/16 System	MGA	EGA	VGA
40MB	$2,355	$2,705	$2,825
80MB	$2,545	$2,895	$3,015

On-Site Service. You'll get On-Site warranty protection *free* for a full year when you purchase any CompuAdd 286/20 or 386 computer. Once your service contract is in effect, just call our toll-free customer support line at the first sign of a problem. If we can't solve it on the phone, a field technician will be at your office the next business day.

"CompuAdd is serious about selling to corporations, and it's got the demonstration, training, support, and service policies to prove it."

Personal Computing (2/89)

Free INTEGRATOR™ Software

All 286 and 386 systems come with the user-friendly INTEGRATOR software package, featuring program/file managers, cardfile database, calendar, calculator, text editor, and PC-FullBak™.

CompuAdd 386/20

- 80386 processor running at 20MHz or 8MHz
- 0 wait state (32KB cache memory)
- 32-bit high speed RAM board with 1MB RAM expands to 16MB
- System/option ROM shadowing
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Seven expansion slots
- Two serial ports and a parallel port built-in
- 80387/Weitek math coprocessor support
- Enhanced 101-key keyboard
- 23.0 on Norton's SI 4.0 test

$2195

386/20 System	MGA	EGA	VGA
40MB	$2,755	$3,105	$3,225
80MB	$2,945	$3,295	$3,415

CompuAdd 386/25

- 80386 processor running at 25MHz or 8MHz
- 0 wait state (32KB cache memory)
- 32-bit high speed RAM board with 1MB RAM expands to 16MB
- System/option ROM shadowing
- Choice of 5.25" 1.2MB or 3.5" 1.44MB diskette drive
- Dual diskette/hard drive controller
- Seven expansion slots
- Two serial ports and a parallel port built-in
- 80387/Weitek math coprocessor support
- Enhanced 101-key keyboard
- 28.8 on Norton's SI 4.0 test

$2895

386/25 System	MGA	EGA	VGA
40MB	$3,455	$3,805	$3,925
80MB	$3,645	$3,995	$4,115

"... packed with features—at prices that won't empty your savings account."

PC Magazine (5/30/89)

One-Year Limited Warranty

If we can't correct a hardware problem over the phone, you can ship your system to our Austin office and we'll fix it and pay the freight back to your location.

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A workhorse system based on the trusty Turbo/10, a *PC World* "Best Buy." Perfect for students or home users.

Kit includes:

CompuAdd Turbo/10 computer running at 10MHz and 4.77MHz; 640KB RAM; 5.25" 360KB diskette drive; diskette drive controller; eight expansion slots; math coprocessor support; and choice of AT-style, 5151, or enhanced 101-key keyboard.

Monochrome monographics monitor or upgrade to EGA or VGA color video.

Star Micronics NX-1000™ printer with multiple type styles, 144cps draft and 36cps near letter quality.

Hard Drive upgrade increases your system capacity with an optional 30MB hard drive. See the chart below.

Accessories and software including paper, printer cable, ten diskettes and Spinnaker® Eight-in-One™ integrated software. Plus CompuAdd MS-DOS® (v4.01) and GW-BASIC.® PC-FullBak™ software with optional hard drive.

$879

Hard Drives	Monographics	EGA	VGA
No Hard Drive	$879	$1,229	$1,349
30MB	$1,129	$1,479	$1,599

Professional Starter Kit™

Our best selling kit. The CompuAdd 286/12 is a popular entry-level computer for the business environment due to its low price and 286 performance. *InfoWorld* said of the 286/12, "The system combines high speed and a low price for a very good value."

Kit includes:

CompuAdd 286/12 computer running at 12MHz and 6MHz; 512KB RAM expandable to 1MB; 5.25" 1.2MB diskette drive; 30MB hard drive (or upgrade, see chart); eight expansion slots; math coprocessor support; and choice of AT-style, 5151, or enhanced 101-key keyboard.

Monochrome monographics monitor or upgrade to EGA or VGA color video.

Panasonic® 1180 printer with tractor/friction paper feed, printing 192cps draft and 38cps near letter quality.

Accessories and software including paper, printer cable, ten diskettes and CompuAdd INTEGRATOR™ with program/file manager, cardfile database, calendar, calculator, text editor, and PC-FullBak software, plus CompuAdd MS-DOS (v4.01) and GW-BASIC.

$1495

Hard Drives	Monographics	EGA	VGA
30MB	$1,495	$1,845	$1,965
40MB	$1,595	$1,945	$2,065

Monitors

Monographics

Flat screen monitor with 12" screen and tilt/swivel . . $95

CGA

IBM-compatible color monitor with 14" diagonal screen $239

EGA

IBM-compatible 14" EGA monitor $349

VGA

Amdek 432W VGA monochrome monitor with flat screen and tilt/swivel . . . $220

Color VGA 14" analog monitor $379

Zenith 14" Color VGA monitor 640×480 . . . . . $649

Combos

Monographics Combo
Monographics 12" flat screen monitor with tilt/swivel, plus monographics card . . $139

CGA Combo
CGA 14" IBM-compatible monitor with up to 640×240 resolution, plus CGA graphics card $279

EGA Combo
EGA 14" IBM-compatible monitor with 640×350 resolution, plus EGA graphics card $489

VGA Combo
VGA 14" analog monitor with 16 out of 256K colors, plus VGA graphics card . . $579

Super VGA Combo
Mitsubishi Diamond Scan monitor with resolution up to 800×600 and dot pitch of 0.31 plus a CompuAdd 16-Bit VGA card $745

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Value/Price Leader

Hard Drives

PC Magazine chose CompuAdd as Editor's Choice for mail-order hard disks *(June 27, 1989)*.

ATs and Compatibles

Seagate®
20MB (65ms) **$219**
40MB (28ms) **$399**
76MB (28ms) full-height **$629**

MiniScribe®
40MB (61ms) **$319**

FREE! with every hard drive purchased.

PC-FullBak™ backup software a $59.95 value by WESTLAKE DATA

XTs and Compatibles

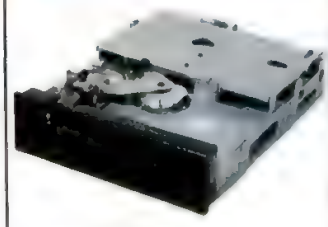
Seagate
20MB (65ms) **$279**

MiniScribe
20MB (65ms) **$279**
30MB (65ms) RLL **$299**
40MB (61ms) **$379**

FlashCards for XTs
Fast, high capacity MiniScribe hard drive mounted on a bracket with controller for trouble-free installation.

FlashCard 20™ (20MB, 65ms) **$299**
FlashCard 30™ (30MB, 65ms) **$329**
FlashCard 40™ (40MB, 45ms) **$399**

Diskette Drives



360KB 5.25" diskette drive for the XT (black) ... **$89**

360KB 5.25" diskette drive for the AT (gray) **$99**

360KB 5.25" Teac® drive for the XT (black) .. **$109**

360KB 5.25" Teac drive for the XT (gray) ... **$109**

720KB 3.5" diskette drive for the XT (black) ... **$89**

720KB 3.5" diskette drive for the AT (gray) **$89**

1.2MB 5.25" diskette drive for the AT (gray) **$95**

1.2MB 5.25" Teac drive for the AT (gray) **$119**

1.44MB 3.5" diskette drive (gray) **$109**

Printers

Epson® LX-810
80 columns, 200cps draft, 30cps NLQ **$199**

Epson FX-1050
132 columns, 264cps draft, 54cps NLQ **$449**

Epson LQ-510
80 columns, 225cps draft, 75cps LQ **$349**

Epson LQ-950
104 columns, 330cps draft, 111cps LQ **$579**

Epson LQ-1050
132 columns 264cps draft, 88cps LQ **$739**

Panasonic 1180
80 columns, 192cps draft, 38cps NLQ **$195**

Panasonic 1191
80 columns 240cps draft, 48cps NLQ **$259**

Panasonic 1524
132 columns 240cps draft, 80cps NLQ **$559**

Panasonic 1595
132 columns, 288cps draft, 61cps NLQ **$465**

Okidata® 321
132 columns, 300cps draft, 63cps NLQ **$465**

Okidata 390
80 columns 270cps draft, 90cps LQ **$469**

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For superior results on paper, no one puts it in print like Hewlett-Packard!

Produce publication-quality printed documents with a Hewlett-Packard LaserJet II. The Hewlett-Packard LaserJet provides high-quality, high-density reproducible copy and graphics for outstanding communications—at up to eight pages per minute! This compact-sized laser printer features 512KB RAM buffer for quick performance and easy down-loading of a variety of fonts. Includes 200-sheet letter-size input tray, an RS-232/parallel interface, and a toner cartridge so you can be immediately productive.

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256KB SIMM modules (100ns) ..... **CALL**
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1MB SIMM modules (100ns) ..... **CALL**

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256KB Chip Set (80ns) .. **CALL**
256KB Chip Set (100ns) .. **CALL**
256KB Chip Set (120ns) .. **CALL**
256KB Chip Set (150ns) .. **CALL**

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8087-3 5MHz coprocessor ... **$99**
8087-2 8MHz coprocessor .. **$149**
8087-10 10MHz coprocessor **$199**
80287-8 8MHz coprocessor **$219**
80287-10 10MHz coprocessor **$259**
80387-16 16MHz coprocessor **$399**
80387-20 20MHz coprocessor **$459**
80387-25 25MHz coprocessor **$589**

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Affordable Accessories

Pointing Devices

Logitech® Serial for AT and PS/2 Mouse programmable with three buttons . . . **$89**

CompuAdd Serial Mouse features Dr. HALO™ III, pad, and pocket **$55**

Microsoft® Bus Mouse mechanical mouse with bus interface. **$119**

Genius Digitizer Tablet provides resolutions up to 1000 lines per inch on a 12" × 12" work area. Includes Dr. HALO III software **$309**

Mach III Joystick **$35**

CompuAdd Joystick . . . **$19.95**

Scanner

Scan Man™ from Logitech captures photographs, drawings, and printed materials for quick input into your computer. Features a large four-inch scanning window. Edit the scanned image with the Scanware™ Graphics Editor included, or place it directly into your Microsoft Windows™ clipboard. **$199**

Keyboard Drawers

Keyboard drawer for storage under CPU or monitor **$35.95**

Undercarriage drawer attaches under desktop or shelf **$24.95**

Tandy Products

FlashCards

FlashCard-20™—20MB drive and controller card mounted on brackets. For 1000/A/SX/TX . . **$319**

FlashCard-30™—30MB drive and controller card mounted on brackets. For 1000/A/SX/TX . . **$359**

Diskette Drives

360KB drive for Tandy 1000/A/SX/TX **$99**

360KB drive for Tandy 3000HL **$99**

720KB for 1000/A/SX/TX **$109**

Hard Drives

20MB half-height drive for 1000/A (65ms) **$299**

20MB half-height drive for SX/TX (65ms) **$299**

20MB half-height drive for 3000HL (65ms) **$369**

40MB half-height drive for 1000/A (61ms) **$395**

40MB half-height drive for SX/TX (40ms) **$439**

44MB half-height drive for 3000HL (25ms) **$639**

Uninterruptible Power Supplies

End data corruption due to power disruptions such as blackouts, surges, spikes, noise, and sags.

NEW! **TSI 3150** for PC/XT/AT and PS/2s **$329**

American Power Conversion Model 520ES for file servers **$499**

American Power Conversion Model 450AT for AT, PS/2-80, and 386 systems **$425**

Cables

Parallel Printer Cables

6′ cable (DB25M to C36M) **$9.95**

10′ cable (DB25M to C36M) **$11.95**

Full Pin Cables

5′ cable (DB25M to DB25M) **$10.95**

10′ cable (DB25M to DB25M) **$12.95**

Cards

I/O Cards

AT I/O serial port, parallel port, and game port **$49**

XT I/O serial port, parallel port, game port, and clock/calendar **$55**

Video Cards

Monographics card up to 720×348 resolution **$49**

Hercules™ Monochrome Graphics Card Plus up to 720×348 resolution **$179**

Hercules Color Graphics card for AT on a half-size card **$149**

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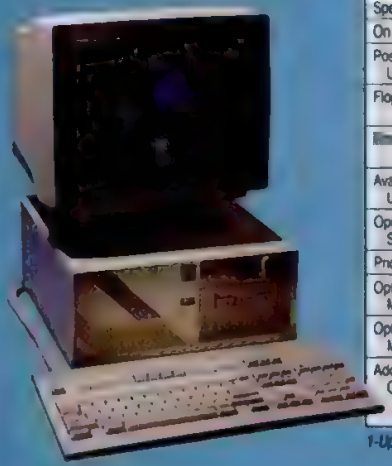

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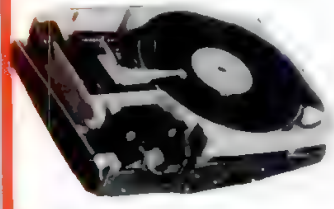

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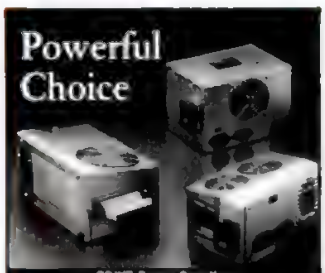

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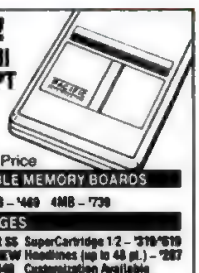

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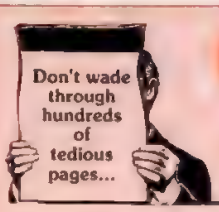

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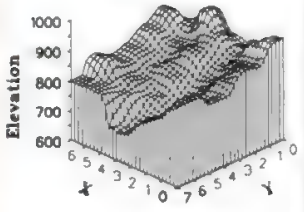

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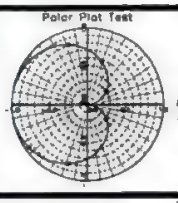

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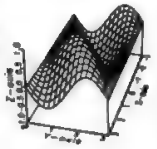

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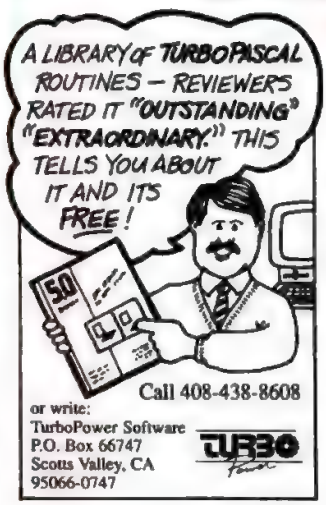

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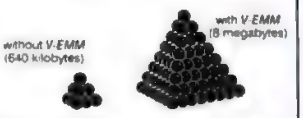

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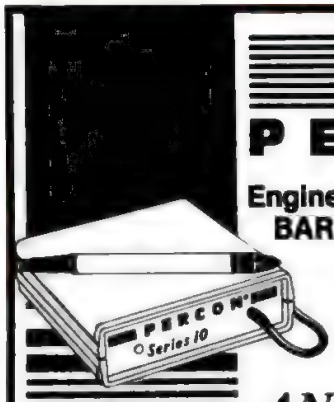

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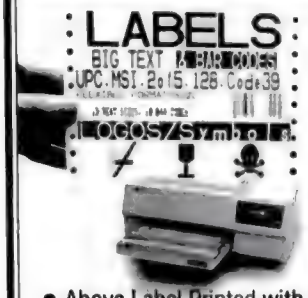

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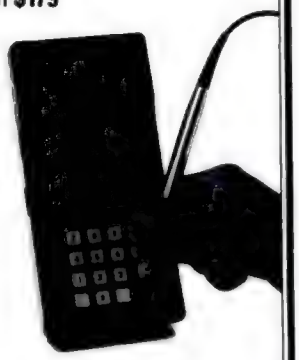

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3. The Seller's notice must contain a stamped self-addressed card or envelope with which you can indicate your preference. If you don't respond to this notice, the Seller may assume you agree to the delay, but must either ship or cancel your order within 30 days after the original shipping date promised or required. A prompt refund must be made when an order is cancelled.

4. Even if you've consented to an indefinite delay, you retain the right to cancel the order at any time before the item has been shipped.

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6. In the event that the item you ordered is unavailable, the Seller may not send you substitute merchandise without your express consent.

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State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order, or the time and date of your conversation, and the name of the person you talk with; and any sales slips and shipping receipts.

Ask about servicing and refund/return policies and with whom you should correspond if there is a problem.

IF YOU HAVE PROBLEMS

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.

2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

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COMING UP

■ 33-MHZ 386 COMPUTERS

Yes, the 486-based computer is on the way. But there's no question that the 33-MHz 386 models now flooding the market are defining the state of the art in the meantime. Considering a machine for CAD, high-end graphics, or networking? Don't miss this look at 22 screamers from companies like Compaq, ALR, and Everex.

■ SOUPING UP VENTURA PUBLISHER

The number-one DTP program in the nation's PC marketplace, *Ventura Publisher* has much to offer when it comes to professional document processing. But optimizing this powerhouse program is no easy task. *Ventura* expert Tami Peterson provides a wealth of tips to maximize your desktop publishing investment, both on and off a network.

■ CD-ROM ON A LAN

When you're doing extensive research, 660MB of data on a compact disk is nothing to shrug off. But many CD-ROM vendors remain unsure of how to license their libraries for network use. For those products now available for LAN usage, here are five solutions—ranging from software-only to fully equipped systems—that enable simultaneous access for a number of users.

■ BASIC LANGUAGES

Many people's first exposure to programming is with DOS's own BASIC interpreter. But BASIC has come a long way since its humble beginnings. *PC Magazine* contributing editor Ethan Winer explores the language's evolution into one that rivals even C and Pascal. We also review Microsoft QuickBASIC, Borland's Turbo Basic, and other products that have helped BASIC grow at a faster pace than any other language in recent years. ■

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PC MAGNET

CIRCLE 497 ON READER SERVICE CARD

After Hours

Products for the Leisure Side of Personal Computing

Prodigy Interactive Service, Intended for Home Users, Has Graphical Interface

[redacted]

Everybody out there who has too little leisure time, raise your hand.

I see quite a few hands. Now, how many of you are interested in on-line access to the news or stock quotes? Want to talk to experts about health, the movies, or personal finance? Need to make travel plans or book airline tickets? Hate to stand on line in the supermarket? Feel like sending electronic mail to your friend on the other side of the country? Don't mind if the computer becomes the electronic babysitter of the '90s?

IBM Corp. and Sears have joined forces to bring you the Prodigy Interactive Service, an attempt to bring home users into the world of on-line information services. For a flat rate of $9.95 per month, you can bank, shop, communicate, play, and educate your family on-line.

To speed acceptance in the market, Prodigy offers a 1,200- or 2,400-bps Hayes Personal Modem with the Start-up Kit for prices of $149.95 or $219.95, respectively. The modem, which plugs into a wall socket, lacks both status lights and a speaker.

Unlike other services that offer the same capabilities, Prodigy uses a graphical interface to attract a wider, less-computer-literate audience. In exchange for the graphics and the low price, these lucky users get a slow, undercooked introduction to on-line life.

AN ARRAY OF SERVICES

The breadth of Prodigy's services has the potential to offer an interesting on-line experience. But IBM and Sears seem to have forgotten a basic law of the market: it's got to be new or better, or people simply won't buy. Prodigy tries, and fails, to compete not only with other on-line services, but with those available via telephone as well.

Most of the information Prodigy offers can be found elsewhere on-line. The flat-rate fee and the graphics weigh in Prodigy's favor, but in return you give up the ability to download information. How useful can *Consumer Reports* be if you can't print it out? Who wants to sit and read automobile comparisons 16 lines at a time? You can view current prices of the stocks in your portfolio, but can't save or print the information.

In the few instances in which the graphics might add value, service providers waste the opportunity. For example, suppose you're going to be in New York and you'd like to order tickets for *Les Misérables*. You can either pick up the phone and call a ticket service, or you can call Prodigy.

Edwards and Edwards, the ticket agents on Prodigy, give you a choice of the best (i.e., most expensive) orchestra or mezzanine seats. No seating chart. No ticket availability listings for specific dates. You might as well call Ticketron—you'll get a wider selection. Lack of selection was a common thread running through most of Prodigy's shopping services.

Prodigy does offer lots of interactive games and activities for children. But do you really want your kid tying up the phone line for hours at a time to play *Where in the World Is Carmen Sandiego?*

In addition to weather reports for regions around the country, Prodigy provides a national weather map.

ON-LINE SERVICES:
LiveWire brings on-line stock quotes to your PC.

InfoLook:
A gateway to a variety of services.

MENU-DRIVEN INTERFACE

The Prodigy screen, which displays CGA-resolution graphics, is divided into four sections. A title runs along the top, and a menu bar occupies the bottom of the screen. A three-line ad-

CONTINUES

LiveWire Uses TV Technology to Feed FNN Stock Quotes to PCs

ON-LINE SERVICES
by Don Trivette

Now you can turn your computer into a couch potato. LiveWire is a television-on-a-board that plugs into one full-size expansion slot on your PC. But LiveWire can't get baseball, *LA Law*, or *The Wonder Years*. It's a very special TV that "gets" only the Financial News Network—from cable or satellite. It "sees" only the stock-market data that crawls across the bottom of the FNN screen.

LiveWire's hardware connects to your cable-TV system with an included splitter and a short length of coaxial cable. During the setup, the hardware scans all of the cable channels until it finds FNN; then it begins searching for the band of ticker information. This process can take 10 to 15 minutes the first time, but once LiveWire locks onto the ticker, it remembers the setup, allowing subsequent sessions to come up in less than 30 seconds.

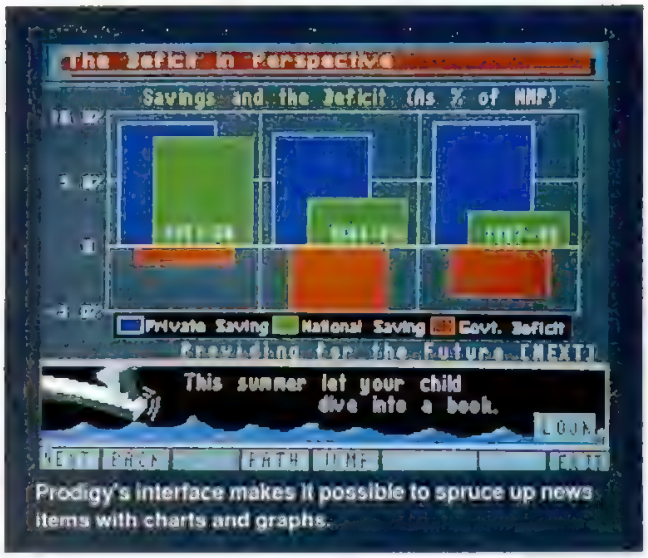
CONTINUES

Prodigy Interactive Service

CONTINUED

vertising blurb sits above the menu bar, and a box in the center of the screen displays 12 lines of text.

You can get around in Prodigy using only the Tab and Enter keys; the interface is entirely menu-driven and relatively easy to use. When you want to meander around the system, following the built-in links among subjects is simple. You can read today's news, for instance, then jump to an editorial about the deficit.



Prodigy's interface makes it possible to spruce up news items with charts and graphs.

The service also employs a "building" metaphor as a second way to navigate. Information and shopping, for instance, are located in separate buildings on a graphically represented "street." Each service is a different "room" in a building.

The shortest distance between two points, however, is a "jumpword," which takes you directly to your destination. The software keeps track of jumps for quick backtracking, and you can create a customized list of jumpwords if you find yourself repeatedly traversing the same territory.

No matter how quickly you enter those jumpwords, though, on an 8-MHz AT with a 2,400-bit-per-second modem you usually have to wait about 10 seconds for the screen to redraw. If that doesn't seem like very long, remember that you're generally interested in only 12 lines of text on each screen.

GETTING STARTED

The manual and the installation program were written with the computer novice in mind, and for the most part they are pretty good. Despite the excruciatingly detailed instructions, however, there are still some omissions and misleading directions.

For example, the manual states, "To maintain your memory-resident programs, you will install part of the Prodigy software on your hard disk, and part on one Personal Disk." The ensuing process creates a bootable floppy from which to run the software.

Of course, booting from a floppy doesn't maintain TSRs; not until the last page of the manual do you find out that the software is incompatible with TSRs and device drivers. It's a RAM hog that wants to run on a clean machine.

I used it on a system with a few programs and drivers resident and encountered no problems, but it's easy to see where conflicts might arise. For faster backtracking, the Prodigy software caches screens in the computer's memory, and caching schemes are notoriously finicky when it comes to memory sharing.

The extensive use of local memory also provides a partial explanation of why Prodigy uses CGA, the lowest common denominator among color graphics standards. (Ironically, Prodigy runs in monochrome on a CGA monitor.) Caching EGA or VGA screens would require even more memory, ostensibly raising the necessary hardware platform beyond the current reach of the service's target market.

As for the advertising that appears on-screen, it's unobtrusive and uninteresting. After an obligatory exploration of book club solicitations, bank come-ons, and computerized catalogs, I ignored the ads completely.

IBM and Sears seem prepared to wait a while for Prodigy to take off, biding their time until today's midrange machines (80286s) become the standard at home. Then they can improve the graphics and information throughput.

But unless they exercise a little imagination to improve the quality and depth of the services provided, this prodigy will never live up to its potential.

List Price: Prodigy Start-up Kit, $49.95 (includes 3 free months); with Hayes Personal Modem 1200, $149.95; with Hayes Personal Modem 2400, $219.95; monthly charge, $9.95. **Requires:** 512K RAM (640K recommended), 1,200-bps Hayes-compatible modem, graphics adapter, DOS 2.0 or later. Prodigy Services Co., 445 Hamilton Ave., White Plains, NY 10601; (800) 822-6922, ext. 205.

CIRCLE 842 ON READER SERVICE CARD

LiveWire

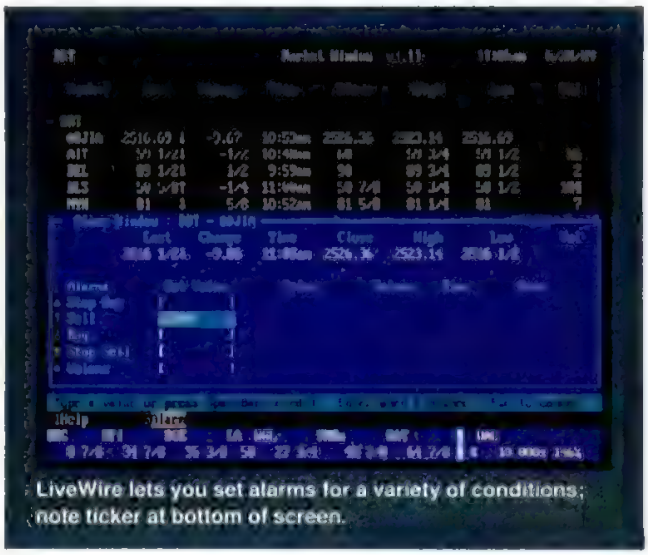
CONTINUED

Once the data begins flowing into the PC, the market ticker is displayed across the bottom of your computer screen. It's in the same abbreviated form that appears on TV: 500 shares of General Motors at 41 3/4 appear as GM5s41 3/4, and 1,000 shares of Coca-Cola at 59 3/4 shows up as KO10s59 3/4. The Alt-T key combination toggles the display window among three choices: the New York Stock Exchange, American/NASDAQ, and transactions for only the stocks in your portfolio.

The transactions on the Financial News Network, like those of competing services, are delayed 15 minutes (real-time quotes cost big bucks), but various market indicators, like the Dow-Jones industrial average, are not delayed. When FNN breaks for a commercial, LiveWire reports "No Ticker" in the bottom window.

This couch potato has more than eyes; LiveWire includes a portfolio-management section that lets you record any number of transactions in any number of portfolios. The software comes with a portfolio of the 30 stocks making up the Dow-Jones industrial average; you can add a portfolio of your own holdings, and perhaps several others for stocks that you want to watch.

CONTINUES


LiveWire lets you set alarms for a variety of conditions; note ticker at bottom of screen.

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After Hours

LiveWire

CONTINUED

All portfolios are automatically updated from the ticker information, and pressing a function key displays such information as current value, percentage gain, and return on investment.

The software is solidly written and works well in the background while other programs are active. I used *Lotus 1-2-3* and Evolution Computing's *FastCAD* while LW kicked back and watched the ticker. An alarm feature lets you set a variety of limits on price and volume movements, but how valuable is an alarm that tells you what happened 15 minutes ago?

LiveWire creates graphs from hourly, daily, or weekly data; this shows the hourly Dow-Jones industrial average.

LW's portfolio manager lacks the panache of programs like *Managing Your Money* and *Dollars and Sense*, and sometimes it's downright cumbersome. If you want to record a group of stocks in alphabetical order, for example, you must enter them from Z to A. There's no way to group stocks (all airlines or all entertainment companies) without making a separate portfolio for each. Still, the portfolio manager will be adequate for most of us.

LiveWire can automatically archive data so that you can plot double-bottom and head-and-shoulders configurations by the hour, day, or week. The trouble is that to plot 6 months of data, LiveWire would have to have been active every day during that 6-month period.

One day I was astonished to see AT&T, the most widely held stock in the country, jump 2½ points. Was Ma Bell taking over IBM? Subsequent transactions were reported accurately, but LW has no way to filter out an error of this type; the incorrect figure showed up as a new high until I manually reset it. LiveWire does have some error-checking routines; a jump of 10 points would be caught and filtered out until several transactions were reported at that value. As always, output is no better than input.

LiveWire is an economical and practical way to follow the stock market hourly. For the investor who relies on charts and trends, it's an effortless way to collect historical data. And even with a list price of nearly $1,000, LiveWire is a bargain when compared with alternatives like *Quotron Open Windows* (see After Hours, April 11, 1989), which has an installation fee and ongoing monthly charges amounting to hundreds of dollars. Better make room on the couch for your PC.

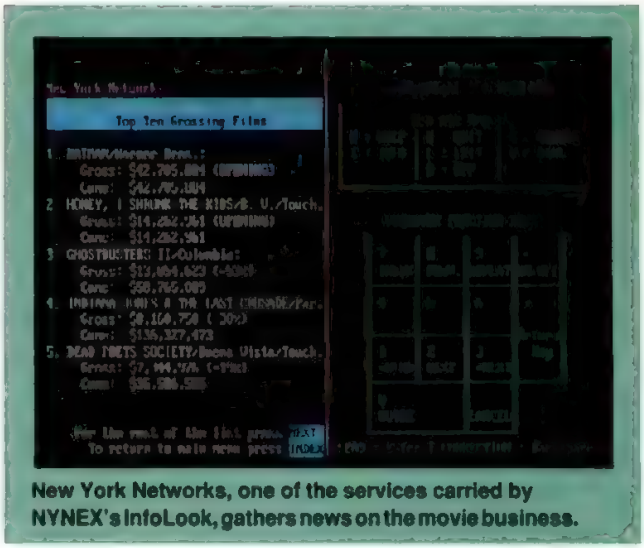
List Price: LiveWire, $995.
Requires: 512K RAM, hard disk, graphics adapter, access to Financial News Network via either cable TV or a satellite receiver. Cable Soft Inc., 307 W. Burlington Ave., Fairfield, IA 52556; (800) 367-7916.

CIRCLE 543 ON READER SERVICE CARD

InfoLook, from NYNEX, Offers a Wide Range of On-line Services

Legal obstacles may prevent AT&T and the regional phone companies from starting on-line services, but a mile-wide loophole is letting them sell the services that others already provide. This growing partnership between regional Bell companies and a burgeoning crop of online entrepreneurs is far from changing the way America communicates, but the union is spawning some interesting and diverse information sources.

One of the healthiest examples is in the Northeast, where NYNEX has started InfoLook. It uses a billing structure borrowed from the "chat," or "party," lines; you pay for connect time on your phone bill. The service requires a calling-card number, and the time spent rummaging through databases tallied next to your calling-card charges. Each service sets its own rate, generally between $.10 and $.25 a minute.



New York Networks, one of the services carried by NYNEX's InfoLook, gathers news on the movie business.

InfoLook is dominated by American Citinet, an independent company that gives an online section to almost anybody with a special interest. American Citinet's VAXes take a 9,600-bps feed from the InfoLook computers and provide about 90 different services out of the 120 now running. The company started as Boston Citinet, selling advertising space on public bulletin boards. Now that InfoLook has created an opportunity for user-supported bulletin boards, Citinet is coming up with a shopping cart full of ideas.

MEDICAL ADVICE

A health line maintains advice on dealing with common ailments. The current selection is too basic to make it worth much of a perusal, but the level of organization and the serious approach are encouraging.

A mortgage-calculator section is a simple loan-payment estimator. Spending time with the service is less expensive than buying one of the programs that typically cost $30 or $40.

Recipes, sports, astrology, and Wall Street rumors are all topics offered by individual services. And then there are the chat lines—plenty of them. American Citinet faces its greatest competition in the wide-open "meeting" arena.

Because so many individual chat services are running on InfoLook, it's a sure bet that the quality of conversation is diluted in any particular area, but it's doubtful that anyone cares. Loose talk is the most popular of the services.

Citinet's greatest competition on InfoLook probably comes from chat-line powerhouse Aline (pronounced a-lean), run by the

CONTINUES

After Hours

InfoLook

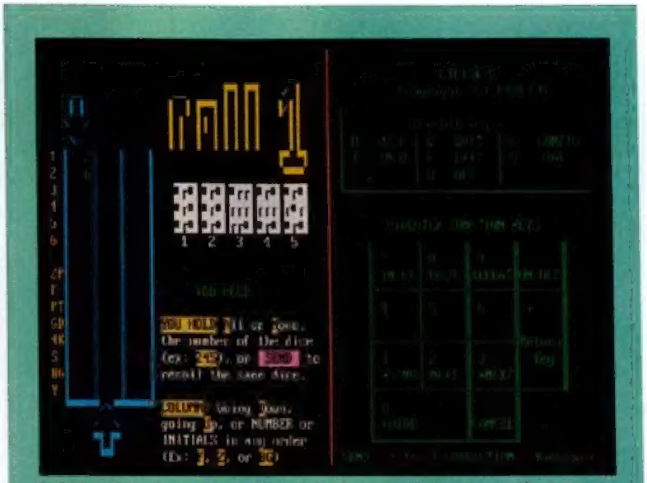
CONTINUED

American division of France's Minitel. Aline's lines are open to the public in the New York City area through a surcharged 540 number, but InfoLook also maintains a gateway.

CHATTING ACROSS THE ATLANTIC

American Minitel brings the flavor of the French on-line system to InfoLook in two ways. A communications program called *CTLink*, sold as shareware by CTL Communications, emulates the Minitel terminals used in France. A PC's numeric keypad is reassigned as Send, Next, Previous, and Index keys. The screen is split, with a keyboard map on the right and graphics screens on the left. Once again, this is an idea with lots of promise that's still half-formed.

In the *USA Today* section, for example, the only interesting use of graphics is in the recreation of the newspaper's logo; all of the other screens are pure text with patches of color.



InfoLook's Arcade section has interactive games that are generally number-based.

Francophiles can tap into the French Minitel network through an international chat line that links with the French service. You don't need to be bilingual, since many of the Minitel callers post in English, but it's definitely a good place to practice your French.

COOKIES AND MOVIES

Film databases and on-line services are a perfect match, and InfoLook is a good matchmaker, providing three separate movie-review services. Each service has a specialty; some concentrate on breadth of coverage; others focus on industry news.

As you browse through the list of services, it's hard not to chuckle; there's a Coffee Connection (for ordering and exploring little-known trivia about the brew) and a cookie line (for ordering only).

Overall, the service has great potential. A Vermont company is running a directory of Vermont businesses. The Boston Computer Exchange is posting its listings. The government of New York's Westchester County may start posting county records. We've hardly begun to consider all the possibilities.

The restrictions that prevent phone companies from starting on-line services may be slowing down progress in the great on-line revolution. If InfoLook is any indication, however, the longer gestation period may result in a richer on-line world.

List Price: InfoLook, $.05 per minute for basic service plus connect charge for individual services, generally between $.10 and $.25 per minute. **Requires:** Modem, communications software. NYNEX Corp., 1113 Westchester Ave., White Plains, NY 10604; (800) 338-2720. ■

CIRCLE 544 ON READER SERVICE CARD

To complete your library of PC Magazine send $8.00 for each back issue ordered ($9.00 in Canada, U.S. funds only) to: Ziff-Davis Publishing Company, P.O. Box 5999, Cherry Hill, NJ 08034, Attn: F. Hunter. Be sure to include month and year of the issue ordered. ***For faster service call 1-609-354-4975.***

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- KEYBOARD

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The CMS-1 - a great music studio everyone can afford!

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PC MAGAZINE EDITORS' CHOICE

"Cakewalk beats higher priced sequencers in many functions and is a great package for the money." 29 NOV. 1988.

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CIRCLE 727 ON READER SERVICE CARD

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by Bill Howard

Abort, Retry, Fail?

The Lighter Side of Personal Computing

Amazing Facts I

"Standard video devices will be the VGA (variable gain amplifier)-compatible interface boards and displays."

—*Digital News*, January 23, 1989

Amazing Facts II

"...potential customers may have shied away from Data General computers because of difficulties in linking the machines to other companies' models, analysts said. Only an IBM-compatible personal computer can use other companies' software."

—*Raleigh (NC) News and Observer*, March 5, 1989

Amazing Facts III

"Video games contain eight bits of information, a bit of information being an amount of power. Even at that, most game carriages don't use their full capacity. So even in an eight-bit carriage, often only five or six or seven bits of power are used."

—*Detroit Free Press*, March 16, 1989

Quick Dispatch–Ask your Micro D sales representative about the Mitsubishi dealer rebate program, *plus* how you can purchase a free demo unit of the mp286-220 laptop at 50% off the suggested retail price!

So how much do you save getting a free demo unit at half off? Micro D distributor's ad in *Computer Reseller News*, January 9, 1989.

For installation instructions and testing information, refer to the manual supplied with the computer.

Circle Game

Page-by-page details of IBM's four pages of instructions for installing a math coprocessor — Page 1 provides an advisory, "For installation instructions turn to page iv." Pages 2 and 3 (Arabic numerals) have two pages of warranty and warranty disclaimers. Page iv (the documentation shifts to lowercase Roman numerals) provides these installation instructions: "For installation instructions...refer to the manual supplied with the computer."

Unfinished Business

When floppy disk vendors list disk capacities on the boxes, they show only the unformatted capacities, for instance 2MB on the high-density Verbatim disks pictured here. That confuses users no end, since they know they need 1.44MB floppy diskettes. Vendors: Is it too much to ask to list the working capacities, too?

ILLUSTRATION: RICHARD TENNANT

PC Magazine offers $50 and a *PC Magazine* T-shirt if we use your submission in Abort, Retry, Fail? Warning: Don't write on the original if it might be reprinted; mark up a photocopy or use a Post-it. In case of duplicate entries, the neatest entry wins. Winners this issue: Bud Turner (math co-processor); ; Ron Bishop (free demo, 50% off); Dave Bushong (V.32); Karl Keip (VGA); Jim Stevenson (Data General); Jon Kruse (video games).

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OUR SYSTEM 310 IS FASTER THAN A BAT OUT OF HELL.

If you've been looking at 386®-based computers, you obviously feel the need for speed. Something the Dell System 310 delivers in spades.

In fact, the System 310 has more speed than even the most seasoned 386 users have come to expect.

Case in point, PC Labs benchmark tests. The 310 consistently outperformed the Compaq® 386/20e. Not to mention the IBM PS/2® Model 70-121. Leading one reviewer to comment, "It's fast enough to burn the steel off a decent floor."

For us, however, fast enough is not enough.

By utilizing an Intel® 82385 Cache Memory Controller, interleaved memory and page mode RAM, the 310 not only delivers all that speed, but enough horsepower to do everything from GAUSCAP to megaspreadsheets to data-base the size of the Manhattan Yellow Pages.

It even has the umph to work as a network file server.

TELL US WHAT TO DO NEXT.

As much as the System 310 has to offer, it doesn't even begin to reach its full potential until after we've heard your input.

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Do you do a lot of spreadsheets? There's an optional Intel 80387 or WEITEK 3167 math coprocessor available. Strange? You can have a 40 MB hard disk drive. Or choose a 100, 150, or 322 MB hard drive.

The System 310 comes standard with 1 MB of RAM. More user's? We can configure up to 8 MB on the system board. Still not enough?

We can add another 8 MB by installing a high-speed memory expansion board.

You can even run your 310 as either a MS-DOS® MP/CPM-86® or UNIX® system. It's your call.

The same holds true for monitors. You can choose between VGA Monochrome, or VGA Color Plus and Super VGA for higher resolution colors displayed on a larger screen.

The point here is that when you order a System 310, you not only get a 386-based system that's incredibly fast, powerful and versatile, but incredibly personal as well.